

The Level of Interest and Readiness of Students Towards the Introduction to The Concept of IoT Using the Home Automation Kit System

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Abstract

With the rise of Industry 4.0 in the Industrial Revolution, educational approaches are rapidly adapting to include technological advances. A notable advance is the Internet of Things (IoT), which facilitates the interconnection of devices for automated processes, offering great opportunities to enrich educational methods. This research delves into introducing IoT principles to students through Home Automation Kit Systems, to increase their interest and readiness for this technology. Despite the integration of IoT in various sectors, students often struggle to understand its theoretical aspects without practical exposure. Conventional teaching techniques fail to prepare students for real-world IoT applications, prompting the need for innovative strategies to bridge this gap. This study aims to measure students' interest and readiness towards the concept of IoT through the Home Automation Kit System. This research involved 22 students of the Diploma in Electrical & Electronics Engineering (DEE) and Diploma in Communication Electronics Engineering (DEP) programs at Mukah Sarawak Polytechnic who attended the DEC50132 Internet Base Controller course in session II:2023/2024. This study uses quantitative methods, and questionnaires are used to assess interest and readiness. Data were analyzed using R programming, providing a comprehensive statistical analysis of the responses. The results indicated a high level of interest, with statements such as "Exploring the home automation system kit can be a fun experience" and "Using this home automation system kit will be an interesting learning experience" receiving a perfect score of 1.00. Students also strongly agree with the interactive and motivational nature of the system compared to conventional methods (mean score 1.00). However, confidence in using IoT concepts showed a slightly lower mean score at 0.82, indicating areas for improvement in practical understanding. The results suggest that the Home Automation Kit System effectively increases students' interest and willingness to learn IoT concepts. Students widely acknowledged the attractive nature of the system and its potential to enhance understanding. Nevertheless, a stronger emphasis on practical applications is necessary to increase students' confidence in using IoT concepts in practical settings. This study highlights the importance of integrating hands-on learning tools to equip students for the technological challenges of the future.

Keywords: - Home Automation Kit System, Internet of Things, interest, readiness

1. Introduction

The evolution of teaching methodologies is advancing swiftly alongside technological progress. The Internet of Things (IoT), a pivotal advancement in information and communication technology, facilitates seamless interaction among various physical devices through internet connectivity, promoting automated and centralized data exchange (Atzori et al., 2010). Recognizing this, Polytechnic Malaysia is updating its curriculum to meet industry needs, exemplified by courses like Embedded Robotics and Internet-Based Controllers.

In response to technological trends, the polytechnic has introduced a syllabus that integrates IoT concepts into its education programs. The

Internet-Based Controller DEC50132 course, specifically for the Department of Electrical Engineering, aims to familiarize students with basic IoT applications. Traditional theory-based instruction often falls short in conveying IoT concepts effectively compared to hands-on learning. Hussain et al. (2020) argue that practical learning provides students with real-world experience, enhancing their understanding of IoT's interactions.

To address these educational challenges, teaching methodologies must evolve to include more effective, technology-enhanced approaches. Lambri & Mahmood (2016) highlight that using technological teaching aids enables students to independently analyze and solve problems, thus facilitating a more efficient learning process.

Introducing IoT through hands-on trainers can significantly boost students' engagement and readiness, providing practical applications that complement theoretical knowledge. This approach not only addresses current educational challenges but also leverages IoT's potential to enrich learning environments, improve resource management, and foster greater interaction.

This study investigates the levels of student interest and readiness for IoT education using the Home Automation Kit System. The findings aim to provide insights into how well students engage with and comprehend IoT concepts. The Home Automation Kit system serves as a Teaching Aid Tool, making complex IoT principles more tangible and engaging (Musa & Mohamad, 2013). Learning kits simplify abstract concepts, aiding comprehension and making the learning process more dynamic.

Understanding student interest and readiness is crucial for effectively introducing IoT concepts. These factors significantly impact how students engage with and absorb new technological knowledge. By assessing interest and readiness, educators can refine teaching methods to better align with student needs, ensuring a more impactful and comprehensive learning experience. Practical tools like the Home Automation Kit can bridge the gap between theory and practice, enhancing IoT comprehension and retention. Interest is a crucial factor in student engagement and academic achievement. According to Resnalia (2022), interest is described as the eagerness and openness to learn, motivating effective learning through continued efforts in overcoming obstacles. Recent educational research underscores the significant influence of student readiness on learning outcomes. Winarso (2016) found a positive correlation between student readiness and academic achievement among junior high school students. These findings suggest that preparing and engaging students effectively can enhance educational outcomes, especially in introducing new technological concepts like IoT. Utilizing hands-on trainers and interactive learning methods can increase student interest and readiness, thereby improving their understanding and application of IoT technologies.

2. Methodology

This study employs a survey using a quantitative approach to gather information about students' interest and readiness in learning the concept of the Internet of Things (IoT) using home automation system kits. A structured quantitative study design was implemented to obtain relevant data. The primary tool for data collection was a questionnaire, which was created using Google Forms. The link to the form was distributed to students enrolled in the Internet Base Controller course, who participated as respondents.

2.1 Question Design

In designing the research question, previous studies were referenced, and adjustments were incorporated to match the current study's focus. This research employs a survey questionnaire aimed at participants enrolled in Internet Base Controller courses, comprising multiple sections that respondents are required to complete. To ensure accuracy, the questionnaires were distributed to individuals who had utilized a home automation kit system, gathering responses based on their insights and experiences. This research uses a 2-point Likert scale. The 2-point Likert scale is well-suited when the research question seeks a clear-cut, action-oriented and minimized response burden from participants on a specific issue. It also simplifies responses and may be easier for respondents to complete quickly the questionnaire however it has their own advantages and limitations. Table 1 shows the division of the questionnaire instrument used contains three parts, namely Part A about the demographics of the respondents; Part B is related to the level of student interest while Part C includes items about the level of student readiness in introducing the concept of IoT through the integration of home automation kit systems as an educational tool.

Table 1. Division of survey form sections

Section A	Demographics
Section B	Measuring the level of student interest in the concept of IoT through the integration of home automation kit systems as an educational tool
Section C	Measuring the level of student readiness for learning about the IoT concept through the utilization of a home automation kit system as an educational tool

Table 2 shows interpretation score mean based on 2-point Likert scale reference from (Alzahrani et al., 2019)

Table 2. Interpretation score mean

No	0.0 – 0.5
Yes	0.51 – 1.0

2.2 Reliability Test

A pilot test was conducted to evaluate the effectiveness and impact of the Home Automation Kit System on students' interest and readiness in learning the Internet of Things (IoT) concept. Given the relatively small number of potential participants, it was decided to include all 22 respondents in the sample. This approach was taken to ensure that the data collected was comprehensive and representative of the target population, despite the limited sample

size. Incorporating all 22 respondents offers numerous advantages as it optimizes resource utilization and prevents the exclusion of any data points, a crucial aspect in studies with limited populations. By engaging all possible participants, this research strives to enhance the reliability of its findings and results. The reliability analysis yielded a value of 0.83, exceeding the threshold of 0.7 indicated in Table 3. Consequently, the questionnaire's reliability level is deemed acceptable and suitable for further research. This value indicates the internal consistency of all items. The higher the raw_alpha value, the better the reliability. In table 3 shows that the raw alpha is 0.7, which indicates sufficient reliability, but could be improved. While the standard alpha coefficient value, adjusted for questionnaire items, indicates internal reliability. A higher value suggests better reliability. In the analysis, a standard alpha of 0.72 in Table 3 shows sufficient reliability. Cronbach's alpha measures agreement on a 0 to 1 scale, with higher values indicating stronger item agreement by Frost (2023). This is Guttman's Lambda 6 or Squared Multiple Correlation (SMC), which is another measure of internal consistency. This value is the sum of squared correlations between each item and the total score and can provide a better picture of reliability if any items are deleted. Higher SMC values indicate better reliability whereas the analysis shows, the SMC is 0.83, indicating good reliability.

Table 3. Division of survey form sections

Raw alpha	Standard alpha	Squared Multiple Correlation	Mean
0.70	0.72	0.83	0.94

2.3 Research Sampling

The study primarily centers on respondents enrolled in Internet Base Controller courses session II:2023/2024 due to the curriculum's emphasis on IoT concepts where upon completion of these courses students should able to apply knowledge of basic concepts, structures, and components of Internet of Things (IoT) in electrical and electronic engineering field which measures the student cognitive and psychomotor. The research sample consists of 22 individuals, representing a 100% response rate, which fulfills the required sample size for questionnaire completion. The reliability coefficients' accuracy varies depending on the sample size. A strong positive correlation between the number of items and the reliability coefficient. It is essential to consider the disparity in the number of items.

3. Result and Discussion

For the result in this study, quantitative methods were employed using R Programming, a programming language, was developed in 1993 by Ross Ihaka and Robert Gentleman at the University of Auckland, New Zealand. The name "R" is derived from being a follow-up to the S language and the initials of its creators. It is an open-source language extensively employed for data analysis, statistical computing, and visual representation. (Kabir et al., 2020) R It is also a very powerful and complete tool, especially adapted for statistical methods. It excels in data manipulation, calculations, and creating plots. Key features comprise an integrated and well-thought-out documentation system (in English), efficient data handling and storage procedures, a range of operators for table calculations, particularly matrices, a comprehensive set of statistical procedures for data analysis, advanced graphical tools, a straightforward and effective programming language with conditional statements, loops, recursion, and input-output functions (Lafaye de Micheaux et al., 2013). Microsoft Excel was utilized to simplify the analysis and present the findings in a tabular format, showcasing percentages, frequencies, and means. Referring to Table 4, it is observed that most respondents are male, accounting for 77%, while females make up 23%. The students enrolled in this course belong to two programs: DEP, representing 14%, and DEE, accounting for 86%. This discrepancy is due to the elective nature of the course and the lower enrolment trend among Mukah Polytechnic students, especially in the Department of Electrical Engineering. All respondents seem to have experience with home automation Kit system.

Table 4. Respondent demographic

		Frequency	Percentage (%)
Gender	Female	5	23
	Male	17	77
Experienced in using home Automation kit system	Yes	22	100
	No	0	0
Program	DEP	3	14
	DEE	19	86

Table 5 provides a comprehensive analysis of students' interest in using the Home Automation Kit System to introduce the Internet of Things (IoT) concepts. The table reports mean scores for various aspects of the learning experience, all on a 2-point Likert scale. Students unanimously found exploring and learning with the kit enjoyable and engaging, each aspect scoring a perfect (mean score:1.00). These aspects include the overall enjoyment of using the kit, interest in learning, fascination with IoT, understanding enhancement, motivation, and

eagerness to explore IoT further. However, two aspects scored slightly lower: confidence in applying IoT concepts (mean score:0.82) and the kit provides a clear picture of practical IoT applications in everyday life (mean score:0.86). Despite these lower scores, the overall results indicate a very high level of interest and motivation among students for using the Home Automation Kit System to learn about IoT, suggesting the potential for this educational tool to significantly enhance the learning experience.

Table 5. Distribution of students' interest levels in using Home Automation Kit System to introduce the IoT concept

Distribution of students' interest levels in using Home Automation Kit System to introduce the IoT concept	Mean Score
Exploring a home automation system kit can be an enjoyable experience.	1.00
Using this home automation system kit will be an interesting learning experience.	1.00
I'm totally intrigued by this whole IoT thing	1.00
A home automation system kit can enhance understanding of the IoT concept.	1.00
Home Automation Kit System more engaging for learning compared to traditional methods	1.00
I feel motivated to learn about IoT through a home automation system kit.	1.00
I feel more confident in applying IoT concepts after using a home automation system kit.	0.82
I want to try a home automation system kit after watching a demonstration.	1.00
home automation system kit gives a clear picture of how IoT can be used in everyday life.	0.86
I am eager to delve deeper into IoT by exploring a home automation system kit.	1.00
A home automation system kit can enhance understanding of IoT concepts.	1.00

Table 6 presents an analysis of students' readiness to learn about the Internet of Things (IoT) using a Home Automation Kit System. The overall results indicate a high level of readiness among students. They show a strong willingness to invest extra time outside of class (mean score: 0.91) and collaborate on projects involving the kit (mean score: 0.95). Students find learning with the kit more engaging than traditional methods (mean score: 1.00). They are motivated to learn more about IoT (mean score: 1.00). They also believe that hands-on experience with the kit will help them understand practical applications of IoT in everyday life (mean score: 0.95) and recognize the importance of IoT for their future careers (mean score: 0.86). However, there is a moderate level of confidence (mean score: 0.82) in using the kit to learn new concepts. Additionally, students report significant challenges, such as difficulty in understanding IoT concepts (mean score: 0.95) and feeling overwhelmed by the complexity (mean score: 0.77), which leads to frustration when they cannot solve IoT-related problems (mean score: 1.00). Despite these challenges, students find the kit makes learning more interactive and fun (mean score: 0.82) and feel capable of creating systems related to

IoT (mean score: 1.00). Therefore, while students demonstrate strong readiness and enthusiasm, addressing the challenges they face in understanding complex concepts and reducing feelings of overwhelm will be essential for enhancing their learning experience.

Table 6. Distribution of students' readiness levels for introducing IoT concepts using Home Automation Kit System

Distribution of students' readiness levels for introducing IoT concepts using Home Automation Kit System	Mean Score
I am ready to spend some extra time outside of class to learn IoT through a home automation system kit.	0.91
I am ready to collaborate with friends on a project that involves using a home automation system kit to delve into the realm of IoT.	0.95
Learning IoT through a home automation system kit is more engaging than traditional methods	1.00
I feel confident to try a home automation system kit to learn new concepts in IoT	0.82
I agree that hands-on experience with a home automation system kit will help me understand the practical applications of IoT in everyday life	0.95
I feel that understanding IoT through a home automation system kit is important for your future career.	0.86
I able to create a system related to the concept of IoT	1.00
I feel difficult to understand the concept of IoT	0.95
I feel overwhelmed by the concepts used	0.77
I feel frustrated when you are unable to solve problems related to IoT	1.00
I think using this kit can make learning more interactive and fun	0.82
I am feeling more motivated to learn more about IoT	1.00

4. Conclusion

Based on the research it clearly shows that the Home Automation Kit System has significantly enhanced students' interest and motivation in learning the Internet of Things (IoT) concepts. The mean scores in Table 5 show perfect scores (1.00) for most aspects, indicating a very high level of engagement and positive reception towards the kit. Students find exploring and using the home automation system kit enjoyable and intriguing, which suggests that the practical and hands-on approach of the kit effectively captures their interest.

The slight reduction in mean scores for statements about confidence in applying IoT concepts (0.82) and understanding how IoT can be used in everyday life (0.86) indicates some areas where further reinforcement might be beneficial. These lower scores highlight the need for additional support and clearer demonstrations to build students' confidence in the practical application of IoT concepts and their understanding of its real-world applications. Suggestions to address the lower confidence scores in practical application of IoT

concepts, it is essential to enhance the activity with more comprehensive practical demonstrations and real-life application examples. These demonstrations should clearly illustrate how IoT concepts can be integrated into everyday scenarios, thus improving students' understanding and confidence. By leveraging IoT technology, educators can create dynamic learning environments that cater to the diverse needs of students, thus enhancing both interest and readiness to learn. Providing additional support through detailed guides, video tutorials, and hands-on workshops will reinforce the learning experience, helping to clarify complex concepts and offering step-by-step instructions for practical applications. Encouraging collaborative projects and peer learning sessions can further enhance understanding, as students can share insights and problem-solving strategies, boosting their confidence and comprehension. Implementing a continuous feedback mechanism where students can share challenges and suggestions regarding the home automation kit and IoT concepts will help lecturers identify areas needing improvement. This feedback can be used to make iterative enhancements to teaching methods and materials. Additionally, introducing advanced IoT applications and projects that challenge students to innovate and apply their knowledge in new ways can further stimulate their interest and readiness, effectively bridging the gap between theoretical concepts and practical implementation. By addressing these areas, educators can ensure that the Home Automation Kit System not only maintains its high level of engagement but also effectively prepares students for real-world applications of IoT concepts.

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References

- AlZahrani, A. S., Alshamrani, F. J., Al-Khamis, F. A., Al-Sulaiman, A. A., Al Ghamdi, W. S., Al Ghamdi, O. A., ... & Alkhaja, M. A. (2019). Association of acute stress with multiple sclerosis onset and relapse in Saudi Arabia. *Saudi medical journal*, 40(4), 372.
- Atzori, L., Iera, A., & Morabito, G. (2010). The internet of things: A survey. *Computer networks*, 54(15), 2787-2805.
- Frost, J. (2023). Content validity: Definition, examples & measuring. Retrieved March 12, 2024 from <https://statisticsbyjim.com/basics/content-validity>.
- Hussain, A., Mkpojiogu, E., & Babalola, E. (2020). Using mobile educational apps to foster work and play in learning: a systematic review.
- Kabir, A. I., Ahmed, K., & Karim, R. (2020). Word cloud and sentiment analysis of Amazon earphones reviews with R programming language. *Informatica Economica*, 24(4), 55-71.
- Kolb, A. Y., & Kolb, D. A. (2017). Experiential learning theory as a guide for experiential educators in higher education. *Experiential Learning & Teaching in Higher Education*, 1(1), 7-44.
<https://doi.org/10.46787/elthe.v1i1.3362>.
- Lafaye de Micheaux, P., Drouilhet, R., & Lique, B. (2013). The R software: fundamentals of programming and statistical analysis.
- Lambri, A., & Mahamood, Z. (2016). Pendekatan Berpusatkan Pelajar Dalam Pengajaran Dan Pembelajaran Bahasa Melayu Bagi Membentuk Kemahiran Insaniahpelajar Di Universiti Awam: Student-Centered Approach in the Teaching and Learning of the Malay Language to Develops Soft Skills in Students of Public University. *PENDETA*, 7, 25-34.
- Musa, N. E., & Mohamad, M. H. (2014). Keberkesanan Penggunaan alat bahan bantu mengajar dalam pelaksanaan kursus sains kejuruteraan di Kalangan pelajar diploma kejuruteraan di Politeknik Tuanku Sultanah Bahiyah. *Prosiding PTBS. Politeknik Tuanku Sultanah Bahiyah*.
- Resnalia. (2022). The impact of IoT on education: A case study. *Journal of Educational Technology*, 15(3), 45-58.
- Winarso, W. (2016). Assessing the readiness of student learning activity and learning outcome. *Jurnal Pencerahan*, 10.