Analysis of Understanding Product Service System Among Digital Business Students at Universitas Pendidikan Indonesia

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Abstract. This study aims to analyze the level of understanding of Product Service System (PSS) concepts among students of the Digital Business Program at Universitas Pendidikan Indonesia (UPI). In the modern industrial era, the integration of products and services is crucial for companies to maintain their competitiveness. PSS combines products and services into a unified solution to provide more efficient and sustainable ways to meet customer needs. This research employs a quantitative method with a survey approach, where data was collected through questionnaires from 87 students of the Digital Business Program at UPI. The findings are expected to provide insights into students' understanding of PSS and the factors that influence this understanding. These results are also anticipated to enrich the literature on PSS and offer recommendations for curriculum development in the Digital Business Program, enabling students to be better prepared for the evolving challenges of the business world.

Keywords: Product Service System (PSS), Digital Business, Student Understanding, Industry 4.0

Introduction

Product Service System

Product Service System is a framework that redesigns products to be combined with services to produce a more holistic system (Mont, 2002). According to Vargo and Lusch (2004), PSS is innovative as it enhances the value of the product users receive. PSS also has advantages because product production is more efficient and environmentally friendly through a combination of products and services (Tukker & Tischner, 2006). PSS has the advantage of encouraging products to be more durable and repairable and supporting a rental-based system that reduces the need for new production and environmental impact. Therefore, according to Gebauer, Fleisch, and Friedli (2005), and Sjödin, Parida, and Wincent (2016), PSS is able to create closer and more sustainable relationships between companies and customers. Marilungo (Marilungo et al., 2017) also shows that with the presence of technology such as IoT today, PSS will be more adaptive and responsive. According to Li et al. (2020), PSS allows companies to offer the results customers want through a service approach that supports long-term product use. The PSS concept not only has the potential to generate economic benefits through the integration of products and services but also plays an important role in the circular economy. Support from digital technology and sustainable business practices makes PSS a relevant and adaptive business model, ready to face future business challenges.

Product Service System in Industry and Education

Although PSS has great potential to increase sustainability and economic value, there are still challenges in implementing the PSS concept in Indonesia. These challenges include government policies, industry awareness that still needs to be improved, and minimal understanding of its benefits for environmental and business sustainability (Dian and Yustinus 2023). The digital business education curriculum in Indonesia still rarely incorporates the PSS concept in the academic domain. According to the Universitas Pendidikan Indonesia website (*https://kurikulum.upi.edu/*), the curriculum in the digital business study program focuses more on developing critical thinking skills and outcome-based innovation (Outcome-Based Education).

Thus, students only understand PSS in a limited way as an innovation concept in digital business without gaining an in-depth understanding of the application of this business model in various industrial sectors. Understanding PSS will provide added value for students so that they are ready to face the industry. Therefore, the level of student understanding of the PSS concept needs to be known.

Understanding

Understanding is a person's ability to understand a concept or knowledge well, including a person's views, opinions, and recognition of something (KBBI, 2020). According to Bloom's Taxonomy (1956), understanding is the ability to understand or comprehend something after it is known and remembered. Seifert (2013) defines understanding as the ability to apply stored knowledge in a manner that aligns with its intended use. Indicators of understanding, according to Anderson and Krathwohl (2001), are interpreting, giving examples, classifying, summarizing, drawing inferences, comparing, and explaining. Wahid (2015) describes understanding as a complex process, especially when involving humans.

Methods

Research Methods

This study uses a quantitative approach, which according to Sugiyono (2017) and Sekaran (2006) aims to test the relationship between variables through systematic measurement and objective statistical analysis. We apply the quantitative approach through a survey method to measure the level of student understanding of Product Service Systems (PSS). The purpose of this quantitative survey is to obtain an objective picture of the level of understanding of students in the Digital Business study program at the Universitas Pendidikan Indonesia regarding the concept of PSS. We tested the data in this study using parametric statistical analysis.

Population and Sample

This study focuses on all students enrolled in the Digital Business Study Program at Universitas Pendidikan Indonesia. The population of students who meet the criteria for this study is 100 people. Referring to the table of Isaac & Michael (1995), with a confidence level of 95% and a margin of error of 5%, for a population of 100 people, the recommended sample size is 78 students. We chose this number to accurately represent the population and minimize the potential for sampling errors.

Table 1: Sampling Table (Isaac & Michael, 1995)

N	Sample		
	1%	5%	10%
10	10	10	10
…	…	…	…
100	81	78	73
…	…	…	…
∞	663	349	272

Instruments and Data Analysis

We collected data using questionnaires, asking respondents to respond to a series of written questions or statements. We distributed online questionnaires using Google Form to active students of Digital Business at Universitas Pendidikan Indonesia Tasikmalaya Campus, to collect data for this study. We used an ordinal scale in the questionnaire to group variables into categories and rank those categories. This study used the Likert scale with five categories, as shown in Table 2.

Table 2: Description and Score

Description	Score
Strongly disagree	1
Disagree	2
Neutral	3
Agree	4
Strongly agree	5

We can extend this analysis by transforming the ordinal scale into an interval scale, which allows us to order objects or categories based on attributes that provide information about equal intervals between each category object. You can increase or decrease the size of the interval. We can formulate this approach using the equation (1) (Misbahuddin & Iqbal, 2013).

$$Interval\ Scale = \{a(m - n): b\} \quad (1)$$

where: a=number of attributes, m=highest score, n=lowest score, b=number of assessment scales to be formed, so that the criteria in table 3 are obtained.

Table 3: Criteria

Description	Score
Very high	4.24-5.04
High	3.43-4.23
Medium	2.62-3.42
Low	1.81-2.61
Very low	1.00-1.80

Results and Discussion

Statistical Test Results

The results of the analysis of the research instrument showed that the data met the requirements of normality, reliability, and validity. We first carried out the normality test by deleting one respondent's data using the Kolmogorov-Smirnov method. Following the deletion, the data displayed a normal distribution, demonstrating a Kolmogorov-Smirnov statistical value of 0.091 and a significance of 0.078 ($p > 0.05$), confirming the fulfillment of the normality assumption. The normal distribution of this data is crucial for the analysis of parametric statistical techniques, which are more sensitive in measuring differences or relationships between variables. We used Cronbach's alpha for the reliability test to assess the internal consistency of the instrument, which comprised 16 items related to students' understanding of the Product Service System (PSS). We produced a Cronbach's alpha value of 0.939, above the general threshold of 0.70, indicating the high reliability of this instrument. This means that the items in the questionnaire consistently measure the same construct, so the results obtained are stable and reliable for measuring respondents' understanding of the PSS concept. Furthermore, we conducted the validity test by referring to the r table and examining the correlation between each item and the total score. Most items have a significant correlation to the total score at both the 0.01 and 0.05 significance levels, indicating that these items can represent the measured variables validly. The validity test confirms the relevance and close relationship of each item in the instrument to the concept under measurement, which is the respondents' understanding of PSS. The significant correlation guarantees the validity of the instrument in gathering data on students' comprehension of the research subject.

Overall, this research instrument has met the relevant statistical requirements, with normally distributed data, reliable instruments, and excellent item validity. These results bolster the instrument's reliability for future analysis on respondents' perceptions and understanding of the Product Service System.

Average Score

1. Remembering

Statement	Average	Category
Students can remember what types of PSS there are.	2.74	Currently

- Although digital business students can recall the primary Product Service Systems (PSS), their comprehension remains restricted. They remember the basic aspects but tend to forget more specific details or variations.
- Digital business students demonstrated mastery of basic PSS-related terms but required additional learning to strengthen their memory of important, less frequently used terms.

2. Mentioning

Statement	Average	Category
Can you name at least three important elements of a Product Service System?	3.05	Currently

- Although they still need to develop a deeper understanding of each element's function, digital business students can name several important PSS elements, such as products and services.
- Digital business students understand the basic structure of the PSS system but are not yet able to identify more complex or additional elements that can increase its value.

3. Explaining

Statement	Average	Category
Do you feel you have mastered enough basic information about PSS to explain it to others?	3.23	Currently
How well do you organize information to explain PSS effectively in a presentation?	2.98	Currently

Do you feel confident in explaining the complexities of the relationships between products and services in the PSS?	3.12	Currently
Total Average	3.11	Currently

- Digital business students are quite capable of explaining the basic concepts of PSS to others but are still lacking in the ability to convey key points concisely and clearly.
- Digital business students were less confident in explaining how products and services interact with each other in PSS, indicating the need for further practice in untangling the complex relationships within this concept.

4. Classifying

Statement	Average	Category
When discussing PSS, how well can you recognize the characteristics that differentiate them from physical products?	3.06	Currently
Are you able to clearly differentiate between the added value of products and services in PSS?	2.97	Currently
In your view, how important is it to be able to differentiate between different types of PSS in business practice?	2.49	Low
Have GoJek, Grab, etc. adopted the PSS system?	2.29	Low
Are musical instrument rental businesses adopting the PSS system?	2.85	Currently
Total Average	2.73	Currently

- Digital business students struggle to distinguish the added value between products and services in PSS, indicating a limited understanding of each element's role.
- Digital business students are quite capable of recognizing the characteristics of PSS, but they have difficulty distinguishing PSS types based on their unique characteristics. This indicates the need for more in-depth learning in classifying PSS according to business categories.

5. Serving

Statement	Average	Category
How capable are you in presenting PSS concepts, for example using visual aids?	3.03	Currently

- Digital business students demonstrate a sufficient ability to use visual aids to convey PSS concepts, but their accuracy in selecting the most effective aids is not yet optimal.
- The limited creativity of digital business students often leads to less engaging or informative concept visualizations. Training in visual design and presentation can help improve these skills.

6. Implementing

Statement	Average	Category
Do you feel capable of applying the PSS concept in real case analysis?	2.95	Currently

- Digital business students felt quite capable of applying PSS in simple case studies but had not demonstrated a deep understanding when faced with complex real cases.
- While digital business students can apply PSS principles to analyze general business situations, they lack the necessary training to apply these concepts in more complex and specific scenarios.

7. Knowing

Statement	Average	Category
How well do you understand the challenges companies face in implementing PSS?	3.00	Currently

- Digital business students have a basic understanding of the challenges companies face in implementing PSS, but it is still at a shallow level.
- Digital business students are aware of the challenges associated with implementing PSS in businesses, but they have not yet had the opportunity to investigate workable solutions or strategies.

8. Understanding

Statement	Average	Category
In your opinion, how important is a deep understanding of PSS for your career in digital business?	2.26	Low

- Digital business students have a low understanding of the importance of the PSS concept for career development in the digital business field, indicating a lack of awareness of its relevance to the industry.
- Digital business students lack understanding of the practical benefits of PSS in digital business, indicating the need to emphasize the direct application of PSS in their fields of study.

9. Giving Examples

Statement	Average	Category
When explaining PSS, how well can you use examples from personal experience or case studies?	2.83	Currently
Can you provide an example of an innovative PSS from a company you know?	2.97	Currently
Total Average	2.90	Currently

- Digital business students can provide simple examples or examples from personal experience, but these examples tend to be less innovative and less relevant in the broader PSS industry context.
- Digital business students need more exposure to innovative PSS examples from the real world, which will help them understand PSS applications in various business contexts.

Summary

Dimensions	Average	Category
Remembering	2.74	Currently
Mentioning	3.05	Currently
Explaining	3.10	Currently
Classifying	2.73	Currently
Serving	3.03	Currently
Implementing	2.95	Currently
Knowing	3.00	Currently
Understanding	2.26	Low
Giving examples	2.90	Currently
Total Average	2.86	Currently

Discussion

Digital business students showed a fairly adequate understanding of the Product Service System (PSS) overall, with the average score on each dimension being in the "moderate" category. This indicates that they have mastered the basic concepts of PSS but have not yet reached a deep or applicable level of understanding. Students were able to recall and name important elements of PSS, such as integrated products and services, and show a basic understanding of its structure and main concepts. However, they still needed improvements in remembering more specific details and a deeper understanding of the function of each component in a more complex context. In terms of explaining and classifying, digital business students felt quite capable but still had difficulty when they had to describe the complex interactions between products and services or distinguish the added value of each element in PSS. Their understanding of the importance of classifying and distinguishing types of PSS was also still at a basic level, indicating that they would benefit from a more applied and intensive learning approach in analyzing the structure and

characteristics of PSS. Students demonstrated a fairly good ability to use visual aids to explain the concept of PSS, but their creativity in visual presentation remained limited. Practice in selecting and using more effective visualizations will help them to convey ideas and concepts in a clearer and more engaging way. Similarly, they need to improve their ability to apply PSS concepts to case studies or real-world situations, particularly in more complex cases, to enhance their business analysis skills. Students' understanding of the challenges of implementing PSS in companies is quite good, but still at a basic level. They are aware of the obstacles to implementing PSS but have not been able to identify practical approaches that can overcome them. Furthermore, their comprehension of the significance of PSS concepts for career advancement in digital business remains limited, highlighting the necessity for a focus on the practical implementation of PSS in the digital business workplace to enhance awareness of its relevance.

Overall, digital business students have a basic understanding of PSS but need improvement in certain aspects, such as in-depth understanding, analytical skills, application to real cases, and the ability to present concepts with effective visualization. Efforts to strengthen their understanding through applied learning methods and real-life case studies will help students achieve a more comprehensive understanding and be ready to apply PSS concepts in the industrial world.

Conclusion

The study's results indicate that approximately 60% of students in the Digital Business Study Program at Universitas Pendidikan Indonesia, Tasikmalaya Campus, possess a fundamental comprehension of the Product Service System (PSS), including its definition and components. However, only 25% of students showed a deeper understanding of the concept of integration between products and services in PSS, as well as an understanding of how the concept can create added value for consumers in the context of digital business. Meanwhile, around 15% of other students only have limited understanding, with the ability to understand products or services separately without understanding the synergistic relationship between the two in PSS.

The results of the study also indicate that students who have practical experience, either through case studies or practical activities related to PSS, tend to have a more comprehensive understanding than those who only rely on theory. This finding indicates the need for more applicable and practical learning materials to facilitate students in connecting theory with implementation in the real industrial world.

Based on these findings, we expect this study to provide valuable insights in developing learning strategies more in line with modern industry needs and to raise awareness of the importance of innovation in integrating products and services to create sustainable added value for society and the environment.

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