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Podcast-Based Learning: Evaluating the Success of Learning Media Development in Vocational Education

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ABSTRACT

Purpose – This study evaluates the success of developing podcast-based learning media in Vocational Education Management courses in higher education. The background of this study is the need for innovation in learning media responsive to the development of digital technology, especially in supporting vocational learning that emphasizes practical and applied skills.

Methodology – This study uses a quantitative approach with a survey design and an explanatory and correlational approach through the Partial Least Squares Structural Equation Modeling (PLS-SEM) method. The sampling technique was randomly conducted on 168 students from five Building Engineering Education Study Program classes who had taken the course. The research instrument covers six variables: content, technical aspects, learning design, involvement and motivation, implementation and benefits, and perceived usefulness.

Findings – The results showed that all indicators met convergent validity with an AVE value above 0.847 and high consistent reliability (CR> 0.95). The six aspects of the study contributed an influence of 87.10%, and the five measurement variables contributed 50.40%. Hypothesis H-DIR$_5$ (IBA→PU) obtained a value of $\beta = 0.213$, $T_{statistic} = 2.847$ and $\rho_{value} = 0.005$. Based on this, the value of the technical aspect, implementation aspects, and benefits has a positive influence, which means that the more the two aspects increase, the more the perceived usefulness of media development increases.

Significance – This study provides an empirical evaluation model for the effectiveness of podcast-based learning media in vocational education. These findings can be the basis for developing digital learning strategies that are more effective, interactive, and relevant to students' needs and the demands of the world of work in the digital era. In addition, this study's results can enrich the literature on applying the PLS-SEM model in evaluating technology-based learning media in higher education environments.

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INTRODUCTION

The development of digital technology in the last two decades has revolutionized various aspects of human life, including in the field of education (Laufer et al., 2021; Zaenab et al., 2023; Zhou et al., 2023). Educational technology is no longer just a teaching aid, but has become an integral part of a student-centered learning strategy (Kaniawati et al., 2023; Mahmud & Barnoto, 2023). Innovation of interactive, flexible, and accessible learning media is an absolute requirement in facing the characteristics of a dynamic and mobile digital generation. At the higher education level, especially in the context of the industrial revolution 4.0 and the era of society 5.0, lecturers and institutions are required to be able to design technology-based learning that can increase student engagement, understanding, and learning independence (Akram & Abdelrady, 2022; Hennessy et al., 2022). This urgency is reinforced by the fact that conventional learning systems are often not flexible enough and less adaptive to individual learning needs, so digital technology-based innovation is an inevitable solution. Therefore, digital transformation in education is not just a trend, but an urgent need to create a learning process that is relevant, meaningful, and up-to-date.

Vocational education has different characteristics from general education because it emphasizes mastering technical and applied skills relevant to industry needs (Jaedun et al., 2024; Kebede et al., 2024). In its learning process, vocational education requires a contextual, practical approach, and is supported by learning media that can bridge theory with practice. One of the challenges faced in implementing vocational learning in higher education is the limited face-to-face time and the gap between theoretical material and field application (Arthars et al., 2025; Xie et al., 2025). This raises the need for learning media that is flexible, easily accessible, and able to deliver content interestingly, one of which is podcast media. Podcasts as digital audio-based media allow the delivery of material in a narrative format that can be listened to at any time, so they are very appropriate for the learning rhythm of active and mobile vocational students (He & Hamid, 2024; Kholifah et al., 2024; Zeng et al., 2025). This media is also considered effective in supporting independent learning and repetitively strengthening the mastery of important concepts, making it a potential alternative in 21st-century vocational education.

Using podcasts as audio-based learning media has a strong theoretical basis, especially from multimedia cognitive theory and constructivism (Astuti et al., 2022; Bozkurt, 2020; Zaenab et al., 2023). The Multimedia Cognitive Theory, developed by Wu (2021), explains that learning will be more effective when information is delivered through visual and/or auditory channels in a structured and non-excessive manner. In the context of podcasts, although only relying on auditory channels, clear narrative design, use of interesting sounds, and gradual delivery of information can improve students' cognitive processing. Meanwhile, the social constructivism theory initiated by Adams (2006) emphasizes the importance of experience and interaction in building knowledge. Podcasts allow for cognitive interaction between listeners and content, and open up discussion space when combined with learning or reflection forums. In addition, information processing theory also explains that repetition and segmentation of material through podcasts can strengthen information retention and knowledge transfer. Therefore, theoretically, podcasts have scientific legitimacy as a learning medium that supports active, reflective, and learner-centered involvement.

Previous studies have shown that podcasts have great potential to improve the quality of higher education learning. Arifin *et al.* (2020) found that podcasts can improve conceptual understanding, increase flexibility in learning time, and strengthen students' reflective abilities. Nurdianah *et al.* (2022) and Richard *et al.* (2023) showed that podcasts repeatedly deliver narrative and conceptual material. Reich *et al.* (2021) concluded that podcasts are very useful in supporting lecture-based learning, but are still limited in implementing practicums or contextual learning. Meanwhile, studies in Indonesia, such as those by Novaliendry *et al.* (2022) and Safiah *et al.* (2023), still focus on the design of podcast development, not on the evaluative aspects of the media's success. This gap shows that there has not been much research that systematically evaluates the effectiveness of podcast media in vocational education, especially in vocational education management courses with an analytical approach based on structural models such as PLS-SEM. Therefore, it is important to fill this gap through an evaluative study that describes perceptions and statistically tests the relationship between dimensions in the use of podcast media.

Most previous studies are still exploratory-descriptive and have not provided an empirical picture of the factors that influence the success of podcast media in the context of vocational education (Istiningsih, 2022; Kusuma et al., 2021; Sifuentes & Chans, 2023). In addition, the generalization of findings in previous studies tends to be weak because they have not considered the characteristics of the vocational field, which requires a balance between theory and practice (Achtenhagen & Leona, 2019; Sánchez-Prieto et al., 2021). Based on initial observations in the Building Engineering Education Study Program, it was found that students had difficulty understanding educational management material due to limited lecture duration and tight practicum schedules. Students prefer flexible and easily accessible forms of learning, such as podcast media, compared to conventional teaching materials. However, no systematic evaluation has been conducted in this environment to assess whether the podcast media used is truly effective and meets learning objectives. Therefore, this study is important to answer relevant local needs while strengthening empirical evidence in Indonesia's vocational education context.

This study provides theoretical contributions by expanding the application of multimedia cognitive theory and constructivism in the context of digital audio media, especially podcasts, in vocational education, which has used more conventional approaches. The evaluation model developed through the PLS-SEM approach also offers a new framework for holistically assessing the effectiveness of learning media, including aspects of content, technical, learning design, motivation, benefits, and perceived usefulness. Practically, this study produces data-based information that can be used by lecturers, media developers, and vocational higher education institutions to design and evaluate podcast media in a more targeted and effective manner. The findings are expected to be a reference in making decisions on developing digital learning that meets the needs of vocational students and the demands of today's industry. Thus, this study not only fills the gap in the literature but also directly impacts the practice of vocational education in the era of digital transformation.

Based on the background, theoretical studies, and research gaps that have been described, the formulation of the problem in this study is: to what extent is the effectiveness of podcast-based learning media in supporting the learning process in Vocational Education Management courses in higher education? To answer this formulation, this study aims to: (1) evaluate the effectiveness of podcast-based learning media from the aspects of content, technical, learning design, involvement and motivation, and implementation and benefits; and (2) analyze the influence of each of these aspects on the perception of the usefulness of podcast media through the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach. In more detail, this study formulates two main research questions: (1) What aspects shape the success of using podcasts as learning media in vocational education? Moreover, (2) to what extent does each of these aspects influence the perception of the usefulness of podcast media in supporting learning outcomes?

METHODOLOGY

Research Design

This study uses a quantitative approach with a survey method. This approach was chosen because it is suitable for objectively measuring and analyzing relationships between variables in large populations and allows statistical generalization of results (Fauzan et al., 2023; Fawaid et al., 2022). Data analysis was carried out using Partial Least Squares Structural Equation Modeling (PLS-SEM), one of the methods in Structural Equation Modeling (SEM) that is very suitable for use in exploratory and predictive research. PLS-SEM allows simultaneous testing of measurement models (outer models) and structural models (inner models), and has advantages in handling data with non-normal distributions, small to medium sample sizes, and models with high complexity or many indicators (Hair & Alamer, 2022; Purnomo et al., 2024).

The PLS-SEM approach was chosen because the main objective of this study was to evaluate the influence of various aspects of podcast media (content, technical, learning design, engagement, and benefits) on perceived usefulness in vocational learning. This approach allows researchers to identify direct relationships and estimate each variable's relative contribution to learning outcomes. In addition, PLS-SEM is flexible in analyzing models that are still developing (theory building), which is the evaluative focus of this study. Compared to other analysis methods, such as multiple regression or CB-SEM, PLS-SEM is superior in its

resilience to multicollinearity, data, and missing data, and provides stable estimates in models with many latent indicators (Hair et al., 2020; Nguyen et al., 2022).

Participants

The target population in this study was all students of the Building Engineering Education Study Program at a state university who had taken the Vocational Education Management (VEM) course. This population was chosen because the VEM course has consistently used podcast learning media as part of its learning strategy in the last three years. The sample in this study was taken randomly (random sampling) to ensure fair representation and reduce the potential for bias in selecting respondents (Widyastuti et al., 2023; Zulmi & Tentama, 2024). The selection of this technique aims to increase external validity and generalizability of research results to a broader population in a similar context.

The total valid participants in this study was 168 students, consisting of active students and alums who had taken the VEM course between 2018 and 2022. It should be noted that although the total number of students recorded as taking the course for five years reached 389 people, only 168 respondents filled out the questionnaire completely and validly and met the inclusion criteria (having taken the VEM course and using podcast media). Therefore, 168 is an adequate sample size used in the analysis. This sample size is considered adequate for PLS-SEM analysis, considering the number of indicators in the model and the minimum ratio of the number of samples recommended by Hair *et al.* (2020), which is 10 times the number of indicators in the most complex construct.

Data Collection and Measurements

Primary data collection in this study was carried out through a closed questionnaire compiled based on six main variables, namely: (1) content aspects, (2) technical aspects, (3) learning design, (4) engagement and motivation, (5) implementation and benefits, and (6) perception of usefulness. Each variable is measured through several indicators designed to capture the conceptual dimensions of each construct. This research instrument uses a four-point Likert scale with answer choices: strongly disagree, disagree, agree, and strongly agree, which are designed to minimize neutral responses (Hashim et al., 2023; Kholifah et al., 2024; Widayanto et al., 2021). The development of indicators in this questionnaire refers to previous relevant and empirically validated studies, as listed in Table 1—the Construct of the Research Variables. Several constructs, such as Content Aspects, are adopted from Daryono *et al.* (2021), Kusdiyanti *et al.* (2022), and Novaliendry *et al*. (2022), while Perceived Usefulness refers to the model from Agustini et al (2020), Das & Pradip (2021), and other relevant studies. In addition, the author further developed several indicators based on field observations and the specific context of the Vocational Education Management course to ensure suitability to local needs.

Before the instrument was used in primary data collection, a validity and reliability test was conducted through a pilot study of 30 respondents with similar characteristics. The validity test results showed that all items had a loading factor value above 0.70, indicating that convergent validity was met. The reliability test was conducted using Cronbach's Alpha and Composite Reliability (CR), with the results of all constructs having alpha and CR values above 0.70, indicating that the instrument's internal consistency was perfect. The Average Variance Extracted (AVE) value for each construct also exceeded 0.50, strengthening the construct validity of this instrument. Thus, the questionnaire was declared suitable for use in primary data collection.

Data Analysis

PLS-SEM (Partial Least Squares-Structural Equation Modeling) is used as a statistical technique in this research to measure the relationship between latent variables in the measurement and structural models (Daryono et al., 2024; Fauzan et al., 2023; Sarstedt et al., 2020). Using this approach, this research combines explanatory and correlational elements to understand better the complexity of the relationships between variables in a conceptual model. PLS-SEM allows researchers to test models holistically, including identifying cause-and-effect relationships and correlation relationships between variables, thereby providing a deeper understanding of the observed phenomenon. The outer model testing stage is a measurement model testing stage that aims to prove the validity and estimate the reliability of indicators and constructs. Several

requirements that must be met are the indicator loading factor (λ >0.70) and the reflective construct AVE (>0.50). Reliability estimates use Cronbach's Alpha, Rho_A, and CR values (>0.70) (Al-Fraihat et al., 2020; Hariyanto et al., 2022).

Table 1. The Construct of the Research Varabels

Variables	Indicators	Constructs	References
Material and Content Aspects	Suitability of podcast material	CA1	(Daryono et al., 2021; Kusdiyanti et al., 2022; Novaliendry et al., 2022)
	Relevance of the material	CA2	
	Quality of material delivery	CA3	
	Depth of discussion of the topic	CA4	
	Completeness of the material in the podcast	CA5	
	Clarity and understandability	CA6	
Technical Aspects	Audio quality	TA1	(Agustini et al., 2020; Novaliendry et al., 2022)
	Sound consistency	TA2	
	Podcast length	TA3	
	Ease of podcast access	TA4	
	Simplicity of the download process	TA5	
Learning Design Aspects	Material delivery structure	LDA1	(Daryono et al., 2021; Fan, 2022; Safiah et al., 2023)
	Interesting presentation	LDA2	
	Creativity in varying sound effects	LDA3	
	There are interactive elements.	LDA4	
Involvement and Motivational Aspects	Podcasts increase interest	IMA1	(Hanif et al., 2023; Khajornsilp et al., 2021)
	Podcasts motivate students to study.	IMA2	
	Active engagement	IMA3	
	Podcasts facilitate active participation.	IMA4	
Implementation Aspects and Benefits	Appropriateness to learning	IBA1	(Agustini et al., 2020; Schnurr & Taylor, 2021)
	Retention of material	IBA2	
	Supporting assignments and learning evaluation	IBA3	
	The impact of podcasts on learning outcomes	IBA4	
	The impact of podcasts on skills	IBA5	
Perceived Usefulness	Improved understanding of material	PU1	(Agustini et al., 2020; Daryono et al., 2021; Das & Pradip, 2021; Novaliendry et al., 2022)
	Application in assignments and projects	PU2	
	Knowledge enrichment	PU3	
	Accessibility	PU4	
	Navigation and usage	PU5	
	Student involvement	PU6	
	Interactivity	PU7	
	Convenience of use	PU8	

FINDINGS

PLS-SEM Analysis: Evaluation of Structural Model (Inner Model)

Evaluating the external model aims to prove construct validity and estimate reliability. Indicators must be tested for validity and reliability to determine the items' validity level when measuring the construct. The following is a test of the validity and reliability of the entire model using reflective indicators. In the external model evaluation, convergent validity (factor loading and AVE), discriminant validity (Fornell-Lacker), and internal consistency reliability (Cronbach Alpha-CA, rho_A, and Composite Reliability-CR) were tested. Outer model evaluation is based on the PLS-SEM analysis's cut-off point values for each aspect—Figure 1 results from testing the outer model on the PLS algorithm output in SmartPLS software.

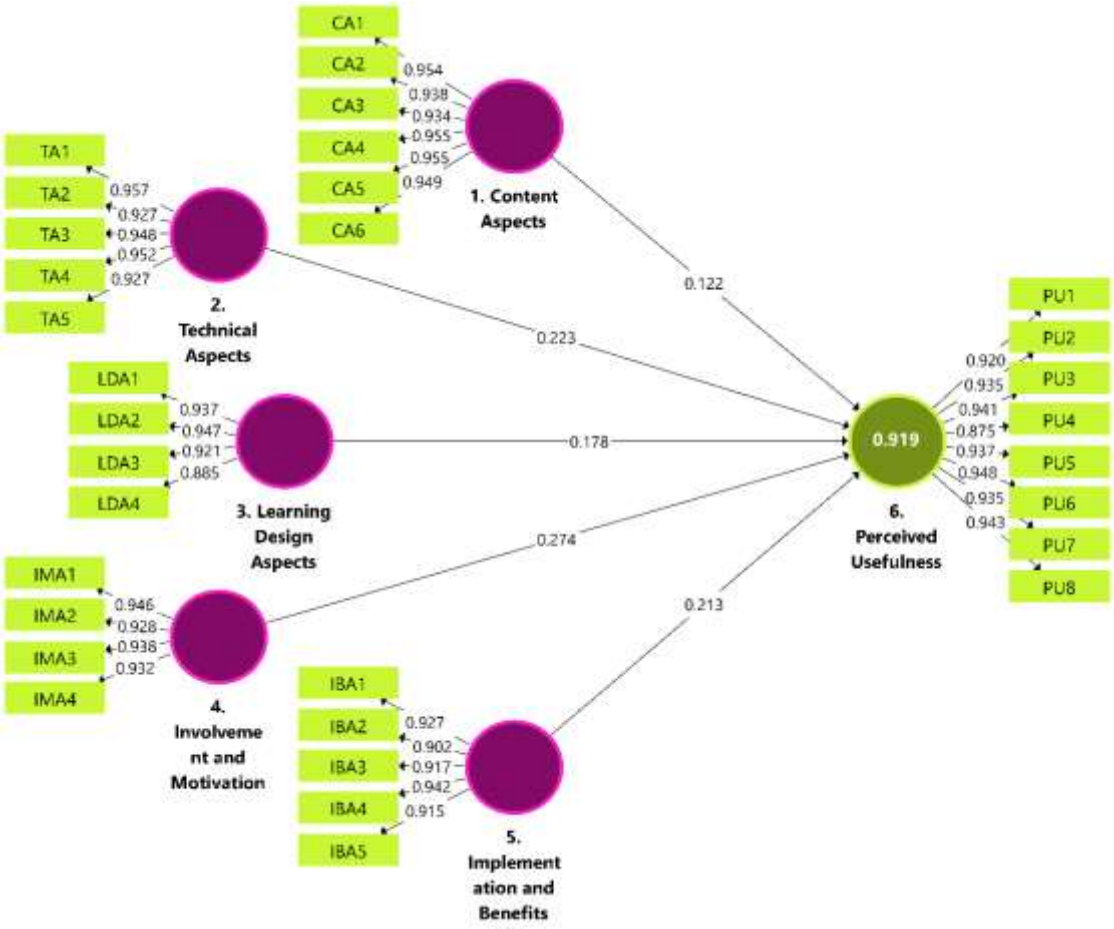

Figure 1. Evaluation of the Measurement Model

Convergent validity in PLS-SEM indicates how well the indicators or manifestation variables used to measure the construct correspond to the actual construct. Researchers can test the consistency between indicators used to measure the same construct by measuring convergent validity. Convergent validity helps ensure that the interpretation of PLS-SEM analysis results reflects the construct you want to measure. Factor loading provides information about how strong the relationship is between the indicator and the construct being measured. Based on Table 2, the factor loading value obtained for each sub-variable is >0.70 (0.875-PU4 to 0.957-TA1). This means that the level of relationship between sub-variables and variables that can be explained is 87.50% (Accessibility) to 95.70% (Audio Quality). AVE is used as a construct validation criterion in PLS-SEM. The AVE value for each variable is>0.50 (0.847-Implementation and Benefits to 0.898-Content Aspects). A high AVE value indicates that the construct has good convergent validity, namely that the indicators fully represent the measured construct. The results of reliability testing revealed that all constructs CA (0.942-CA to 0.977-LDA), rho_A (0.946-PU to 0.978-LDA), and CR (0.958-CA to 0.981-LDA).

Table 2. Outer Model: Convergent Validity and Reliability

Variables	Constructs	Convergent Validity		Consistency Reliability		
		FL (λ >0,70)	AVE (>0,50)	CA (α >0,70)	rho_A (φ >0,70)	CR (δ >0,70)
Content Aspects	CA1	0.954	0.898	0.977	0.977	0.981
	CA2	0.938				
	CA3	0.934				
	CA4	0.955				
	CA5	0.955				
	CA6	0.949				
Technical Aspects	TA1	0.957	0.888	0.968	0.969	0.975

Variables	Constructs	Convergent Validity		Consistency Reliability		
		FL (λ >0,70)	AVE (>0,50)	CA (α >0,70)	rho_A (φ >0,70)	CR (δ >0,70)
	TA2	0.927				
	TA3	0.948				
	TA4	0.952				
	TA5	0.927				
Learning Design Aspects	LDA1	0.937	0.852	0.942	0.946	0.958
	LDA2	0.947				
	LDA3	0.921				
	LDA4	0.885				
Involvement and Motivational Aspects	IMA1	0.946	0.877	0.953	0.954	0.966
	IMA2	0.928				
	IMA3	0.938				
	IMA4	0.932				
Implementation Aspects and Benefits	IBA1	0.927	0.847	0.955	0.956	0.965
	IBA2	0.902				
	IBA3	0.917				
	IBA4	0.942				
	IBA5	0.915				
Perceived Usefulness	PU1	0.920	0.864	0.977	0.978	0.981
	PU2	0.935				
	PU3	0.941				
	PU4	0.875				
	PU5	0.937				
	PU6	0.948				
	PU7	0.935				
	PU8	0.943				

Fornell-Larcker values are explained by the Mark correlation, the latent variable, the Mark correlation, and other latent variables. Based on Table 3 on the Fornell-Larcker test, values correlation of Content Aspects → Content Aspects has a value of 0.947, which is greater than the correlation value of Content Aspects with other variables (Technical Aspects → 0.853; Learning Design Aspects → 0.819; Involvement and Motivation → 0.879; Implementation and Benefits → 0.866; and Perceived Usefulness → 0.883). And so on, to assess correlation with other variables. So it can be concluded that the Fornell-Larcker test of the correlation of all variables in this research instrument meets the requirements of the discriminant validity test in measuring the success of developing learning media supplements for podcast-based vocational education management courses.

Table 3. Discriminant Validity: The Fornell-Larcker

Variables	CA	TA	LDA	IMA	IBM	PU
1. Content Aspects (CA)	0.947					
2. Technical Aspects (TA)	0.853	0.942				
3. Learning Design Aspects (LDA)	0.819	0.833	0.923			
4. Involvement and Motivation (IMA)	0.879	0.884	0.849	0.936		
5. Implementation and Benefits (IBA)	0.866	0.878	0.867	0.924	0.927	
6. Perceived Usefulness (PU)	0.883	0.905	0.881	0.931	0.921	0.929

The initial stage of structural model analysis is looking at the sign of R^2, effect size (f^2), predictive relevance (Q^2), and model fit. The R-squared construct describes the amount of variance explained by the model. F-square aims to evaluate the magnitude of the influence between variables. Q-square predictive relevance measures how much the structural model generates good observed values. Model fit is used to

measure overall model predictions and parameter estimates. Table 4 shows the results of the structural model evaluation.

Table 4. Measurement of Structural Model: R^2, f^2, Q^2

Variables	R Square		Effect Size (f^2)		Predictive Relevance (Q2)		
	Value	Decision	Value	Size	Redundancy	Communality	Power (>0.35)
CA	-	-	0.035	Small	-	0.848	Strong
TA	-	-	0.107		-	0.818	Predictive
LDA	-	-	0.085		-	0.732	
IMA	-	-	0.082		-	0.769	
IBA	-	-	0.050		-	0.759	
PU	0.919	Large	-	-	0.788	0.815	

R^2 (Coefficient of Determination) provides an overview of how well the PLS-SEM model explains variation in the observed endogenous variables (constructs). R^2 allows comparison between different PLS-SEM models. Based on Figure 2 and Table 3, the Performance Measurement and Evaluation (IPPME) aspect obtained an R^2 value of 0.871 in the substantial category (>0.670). This means that the six research aspects together contribute an influence of 87.10%. Furthermore, the Partnerships and Networks (IPN) aspect obtained an R^2 value of 0.504 in the moderate category (<0.670). This means that the five measuring variables together contribute an influence of 50.40%.

Specifically, f^2 (effect size) measures the predictive power of a latent variable against a particular construct in the model. More specifically, f^2 is calculated by dividing the square of the latent variable regression loading on a particular construct by the amount of residual error from that construct. The results show how much the latent variable explains variation in the observed construct. f^2 helps determine how significant the contribution of latent variables is to the observed construct. The strongest variable in measuring IPPME is the IPN variable with an F-squared value of 2.807 in the large category (>0.35). Next, the ERA variable obtained an F-squared value of 0.006 in the small category (<0.15).

The results of the predictive relevance Q^2 (redundancy) calculation are in Table 4, where the obtained Q^2 value is 0.788 (perceived usefulness) in category strong predictive relevance. The results of calculating predictive relevance Q^2 (communality) obtained Q^2 values of 0.732 (learning design aspects) to 0.848 (content aspects) in category strong predictive relevance. So that model results in the study. This can explain amounting to 73.20% to 84.80% of the phenomenon under study It can be concluded that the research model for measuring the success of developing learning media supplements for podcast-based vocational education management courses can achieve a prediction of 84.80% as is the case in the field. The output of the feasibility of the model fit is shown in Table 5.

Table 5. Results of Model Feasibility in Measuring the Success of Podcast-Based Learning Media

Fit Summary	Cut-off Point	Saturated Model	Estimated Model	Decision
SRMR	<0.08	0.030	0.030	Good Fit
d_ULS	≥5.00	0.469	0.469	Marginal Fit
d_G	≥5.00	1.009	1.009	Good Fit
Chi-Square	-	2.135,327	2.135,327	Good Fit
NFI	≥0.50	0.898	0.898	Good Fit
RMS_Theta	≤0.12	0.135		Marginal Fit

Model fit helps in evaluating the overall quality of the PLS-SEM model. SRMR in this study obtained a value of 0.031 (<0.08) in the good fit category. Lower SRMR values indicate a better fit between the model and the data. The d_ULS matrix measures the distance between the theoretical covariance matrix and the empirical covariance matrix observed from the data. However, d_G uses geodesic distances, which provide more accurate information about the fit between the model and the data. The values of d_ULS (0.469) and d_G

(1.009), which are close to zero, indicate that the model effectively reproduces the covariance structure in the data. The higher NFI value (0.898) indicates that the model fits the data perfectly. RMS_Theta obtained a value of 0.135, so the data in this research model is in a good category in matching correlation patterns between latent variables in empirical data.

Path Analysis and Hypothesis Testing

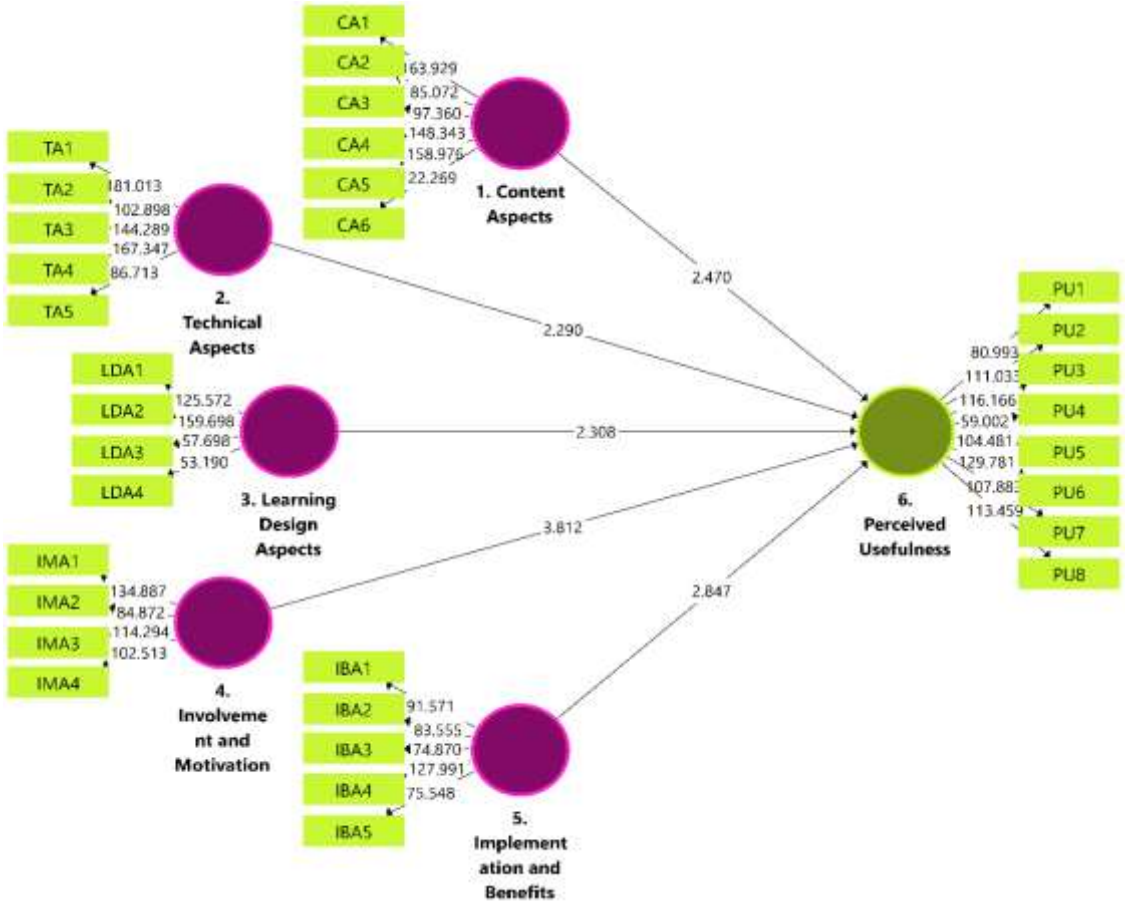

Figure 2. Evaluation of Path Analysis

Hypothesis testing in this research aims to analyze the direct influence relationship between the variables content, technical, learning design, involvement, and motivation, and implementation and benefits aspects on perceived usefulness (Daryono et al., 2023; Mukaromah et al., 2024; Putri & Daryono, 2024; Saifudin et al., 2024). The analysis path is indicated by a greater statistical significance value ($T\text{-}_{value}$) with a value of $T\text{-}_{statistic}$ (α 0.05; $t\text{-}_{statistics} > 1.96$) and a $\rho\text{-}_{value}$ of <0.05. The significance of the influence of variables is indicated by the $\beta\text{-}_{value}$, which indicates the direction of positive or negative influence. A hypothesis can be accepted with significant criteria if its $T\text{-}_{statistic}$ value is >1.96. Meanwhile, the hypothesis can be accepted if the $\beta\text{-}_{value}$ coefficient shows a positive or negative direction of influence. The results of the research model significance test can be seen in Table 6.

Table 6. Results of Path Coefficient: Direct Effects

Hyp.	Path Analysis	$\beta\text{-}_{Values}$ (+/-)	Sample Mean	SDV	$T\text{-}_{Statistics}$ (>1,96)	$\rho\text{-}_{Values}$ (<0,05)	Decision
$H\text{-}DIR_1$	1. CA → 6. PU	0.122	0.132	0.049	2.470	0.014	Accepted
$H\text{-}DIR_2$	2. TA → 6. PU	0.223	0.213	0.097	2.290	0.022	Accepted
$H\text{-}DIR_3$	3. LDA → 6. PU	0.178	0.173	0.077	2.308	0.021	Accepted
$H\text{-}DIR_4$	4. IMA → 6. PU	0.274	0.273	0.072	3.812	0.000	Accepted
$H\text{-}DIR_5$	5. IBA → 6. PU	0.213	0.220	0.075	2.847	0.005	Accepted

The first hypothesis (H-DIR$_1$) shows that the content aspect positively and significantly affects the perception of usefulness (β = 0.122; T = 2.470; ρ = 0.014). This indicates that the better the completeness, relevance, and clarity of the material in the podcast, the higher the students' perception of the benefits of podcasts in supporting the learning process. The second hypothesis (H-DIR$_2$) also shows a significant positive effect of the technical aspect on the perception of usefulness (β = 0.223; T = 2.290; ρ = 0.022). This means that audio quality, sound stability, ease of access, and the right podcast duration directly contribute to the comfort and effectiveness of students in using podcasts as a learning medium.

Furthermore, the results of the H-DIR$_3$ test showed that the learning design in podcasts, including the delivery structure, creativity, and interactive elements, positively affected the perception of usefulness (β = 0.178; T = 2.308; ρ = 0.021). This shows that an organized and attractive design can increase students' perceptions of the usefulness of podcast media. The most significant influence in the model was found in H-DIR$_4$, namely student involvement and motivation on the perception of usefulness (β = 0.274; T = 3.812; ρ = 0.000), which indicates that podcasts that can motivate, actively involve, and encourage participation will significantly increase students' perceptions of their benefits. Finally, H-DIR$_5$ showed that aspects of the implementation and benefits of podcasts in supporting assignments, material retention, and learning outcomes also contributed positively to the perception of usefulness (β = 0.213; T = 2.847; ρ = 0.005). Overall, these results reinforce that the dimensions in podcast design and implementation play an important role in shaping students' positive perceptions of the effectiveness of this media in vocational learning..

DISCUSSION

The findings in the first hypothesis (H-DIR$_1$) show that the content aspect has a positive and significant influence on the perception of the usefulness of podcast media in vocational learning. These results indicate that students consider podcasts useful when the material presented is relevant, complete, systematic, and easy to understand. Theoretically, these findings align with Novaliendry *et al.*'s (2022) cognitive theory of multimedia, which emphasizes the importance of presenting structured verbal information in supporting cognitive processing and conceptual understanding. In addition, these results strengthen previous studies such as Kusdiyanti *et al.* (2022) and Daryono *et al.* (2021), which show that quality audio content can increase engagement and support independent learning. The practical implications of these results indicate that lecturers and media developers need to design podcast content that not only meets the demands of the curriculum but is also contextual to the needs of the vocational work world to increase students' perceptions of benefits. However, the measurements in this study are still limited to students' subjective perceptions, so further research is needed that combines objective content analysis and measurement of actual learning outcomes. The uniqueness of this study lies in its focus on podcast media in vocational management education in Indonesia, which until now has rarely been studied empirically, so that these results can be a theoretical and practical contribution to the development of digital learning media in vocational higher education.

The findings in the second hypothesis (H-DIR$_2$) show that technical aspects positively and significantly influence the perception of the usefulness of podcast media in vocational learning. This shows that the technical quality of podcasts, such as sound clarity, audio stability, ease of access, and compatibility with student devices, is important in determining how much benefit is felt from using this media. These results align with the findings of Agustini et al. (2020), which state that technical factors are one of the main barriers or drivers in students' adoption of audio learning technology. From a cognitive theory perspective, technical barriers can disrupt the flow of information and affect cognitive load, so technically sound media will help learners focus more on the material's content. The practical implications of these findings are that media developers must ensure that the technical aspects of podcasts meet good audio standards, are easily accessible through various platforms, and have intuitive navigation. This study also reminds us that even with high-quality content, without optimal technical support, the perception of media usefulness can decrease significantly. Therefore, further research is recommended to explore the relationship between the technical comfort of use and learning engagement, especially in groups of students with diverse digital backgrounds.

The results of the third hypothesis test (H-DIR$_3$) showed that learning design positively and significantly influences the perception of podcast usefulness as a vocational learning medium. The learning design in question includes narrative structure, material delivery flow, integration of interactive elements such as reflective questions, and continuity of topics between episodes. This finding strengthens the theory of constructivism, which emphasizes the importance of structure and scaffolding in helping learners build understanding gradually (Adams, 2006). Effective learning design in podcast media allows students to be passive recipients and actively build meaning and connections between concepts. This study is in line with Fan (2022) and Safiah *et al.* (2023), which shows that directed and personalized audio design significantly increases engagement and perceptions of the effectiveness of digital media. In practice, these findings emphasize the importance of instructional design training for lecturers or media developers so that podcasts are not just verbal copies of modules, but are developed as stand-alone learning tools. The limitation in this aspect is that it has not been explored in depth, which specific design elements are most influential so that it can be the focus of future research with an experimental or qualitative approach.

The findings in the fourth hypothesis (H-DIR$_4$) show that student involvement and motivation in using podcast media positively and significantly influence the perception of its usefulness in vocational learning. With the highest coefficient value compared to other variables, these results confirm that students' affective and participatory aspects play a central role in assessing the benefits of digital learning media. These findings are based on the principles of social constructivism theory, which emphasize that motivation and active involvement in the learning process are key to building meaning and transferring knowledge (Arifin et al., 2020; Bozkurt, 2020). This study also strengthens previous findings by Hanif *et al.* (2023) and Khajornsilp *et al.* (2021), emphasizing that podcasts that can attract attention and are emotionally relevant can increase learning engagement and retention. The practical implications of these results are that podcast design must consider motivational factors such as a communicative delivery style, engaging presentation, and the existence of content that is close to students' lives. The limitation of this study is that it does not measure motivation longitudinally, so it is not yet known whether the effects are short-term or sustainable. Further research is recommended to evaluate student engagement and motivation using podcasts in different long-term learning contexts and courses.

The fifth hypothesis (H-DIR$_5$) shows that the implementation and benefits aspects positively and significantly influence the perception of the usefulness of podcast media in vocational learning. This finding indicates that students perceive podcasts as a medium that provides real benefits when their use is implemented well in the lecture process, such as being used as part of an evaluation, assignment, or as a complement to class discussions. This supports the theory of technology adoption, which states that the perception of usefulness increases when technology is not only easily accessible but also functionally integrated into learning activities (Schnurr & Taylor, 2021). This study extends the findings of Agustini *et al.* (2020) and Das & Pradip (2021), which previously showed the effectiveness of podcasts as additional media, by providing evidence that strategic implementation can make podcasts a significant component of learning. The implications of these results emphasize the importance of integrating podcasts into semester learning plans, not just as optional additional materials. The limitation in this section is that the study has not tested the most effective form of implementation (e.g., assignments, reflection, or blended learning). Therefore, further research can be directed at podcast implementation design experiments to find the most optimal approach that suits the characteristics of vocational learning.

CONCLUSION

The results of this study indicate that all independent variables, namely content, technical, learning design, engagement and motivation, and implementation and benefits, have a positive and significant influence on the perceived usefulness of podcast-based learning media in the context of Vocational Education Management courses. Statistically, student engagement and motivation have the most dominant influence, followed by implementation and benefits, technical aspects, learning design, and content. These findings theoretically support the cognitive theory of multimedia and social constructivism, which emphasizes the

importance of meaningful instructional design and active learning experiences. In addition, these results align with various previous studies but expand the theoretical scope through the use of the PLS-SEM approach, which tests the relationship between variables simultaneously in the context of audio media-based vocational education. Thus, this study has succeeded in achieving its goal of systematically evaluating the success of podcast media in vocational learning, as well as identifying key factors that influence its perceived usefulness.

These findings provide important implications for lecturers, media developers, and vocational education institutions. Effective podcast design must consider content quality, technical fluency, engaging learning structure, student motivation, and integration into learning activities. Podcasts are not enough as passive aids, but must be actively integrated into learning strategies to provide maximum benefits. The limitations of this study lie in perception-based measurements without directly linking them to measurable learning outcomes, and have not explored in depth the most effective implementation model. Therefore, further research is recommended to combine quantitative and qualitative approaches and evaluate the direct impact of podcasts on learning outcomes. As a recommendation, vocational education practitioners are advised to start designing and implementing podcast media systematically, based on field needs, and develop it through collaboration between lecturers, students, and industry players so that this media is not only informative but also applicable and relevant to the demands of the world of work..

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