International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 4,2025
https://theaspd.com/index.php

Vocational Teachers' Creativity and Independence in Developing Inclusive Mathematics Learning Evaluation Integrated with Design for Change

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Abstract
Evaluating mathematics learning in inclusive vocational schools requires a different approach than in regular schools, as it must accommodate both students with special needs and regular students. Mathematics education in vocational settings aims to prepare students for real-world applications in their fields, highlighting the need for evaluation models that support this goal. This study explores how integrating Design Thinking and the Design for Change approach can enhance mathematics learning evaluation. The Design for Change model, with its stages of Feel, Imagine, Do, and Share, demands teacher independence and creativity to be effectively implemented. The research uses a mixed-methods explanatory design, starting with quantitative analysis through questionnaires and SEM, followed by qualitative interviews and observations. Data were collected from 114 mathematics teachers across 27 inclusive vocational schools labeled as centers of excellence in Bali. Findings from the quantitative phase show that teacher creativity significantly mediates the relationship between the Design for Change approach and learning evaluation. Additionally, the Design for Change approach has a significant positive relationship with teacher independence ($p < 0.05$), although learning evaluation itself does not directly impact teacher independence. Qualitative data further support the necessity of combining Design Thinking with Design for Change to align with the vocational learning spirit. The study underscores the importance of enhancing teacher independence and creativity in evaluating mathematics learning through the Design for Change approach. A practical recommendation is to develop a guidebook to help teachers apply Design Thinking and Design for Change principles effectively, ensuring more inclusive and contextually relevant mathematics evaluations in Bali's vocational schools.
Keywords: Evaluation of Inclusive School Mathematics Learning; Design Thinking; Design for Change; Teacher Creativity; Teacher Independence.

INTRODUCTION

The Inclusive education has become a major focus in modern education systems, aiming to provide equal learning opportunities for all students, including those with special needs (Amahoru & Ahyani, 2023; Suryadi, 2023). Even though it has been widely implemented, inclusive education still faces significant challenges, especially in assessment and evaluation practices (Ratminingsih et al., 2018). Previous research shows that conventional learning models often fail to accommodate the diverse learning needs of students with special needs (Ainscow, 2002); (Paramansyah & Parojai, 2024). Various studies show that until now, parents of children with special needs in Indonesia tended to choose to send their children to special schools. Special schools provide more specific support, but may limit social integration. Inclusive schools seek to bridge this gap by creating a learning environment that allows interaction between students with special needs and their peers in the same classroom. Thus, inclusive education is an effort to provide space for all students regardless of the diversity of student backgrounds and ensure that learning takes place fairly and without bias, and embraces the unique and different needs of each child (Nurfadhillah, 2021); (Saputra et al., 2024); (Sulaiman et al., 2024). However, the effectiveness of this model is highly dependent on appropriate pedagogical strategies and evaluation mechanisms. Evaluation plays an important role in determining the effectiveness of inclusive education (Kurniawan et al., 2023); (Puspita, 2024). A number of studies have examined various evaluation approaches in inclusive classrooms.

Research conducted by (Fransisca et al., 2021) emphasizes that mathematics learning in inclusive schools has similar stages to regular classes, but requires additional support for students with special needs. Research conducted by (Darmawan et al., 2021) highlighted the importance of differentiated evaluation according to students' cognitive capabilities, while (Widana et al., 2023) advocated personalized scaffolding techniques in evaluation. However, evaluation methods used today often do not fully accommodate the needs of students with special needs, resulting in unfair evaluation gaps (Putro et al., 2023); (Rozi & Fuadiy, 2025). The evaluation methods used tend to only use conventional evaluation, such as written tests with routine questions that only measure low-level cognitive abilities. The same evaluation is applied to students with special needs and regular students, although students with special needs often have difficulty understanding the questions (Hayati & Sindhuredja, 2016); (Rofiah & Rofiana, 2017); (Wanbin et al., 2023). This causes them to just copy the questions without giving the right answers, making it difficult for teachers to correct (Nurfadhillah, 2021); (Sakiinatullaila et al., n.d.). In addition, students with special needs were not accompanied by a support teacher during the evaluation process, making them confused (Sakiinatullaila et al., n.d.). According to Mufidah et al. (2021) evaluations that are not relevant to the competencies of students with special needs can reduce their attention, concentration, and self-confidence, thus hindering the optimization of their potential. According to research conducted by (Mansur, 2019), evaluations that do not match the abilities of students with special needs can hinder their achievement of graduation standards. Therefore, effective evaluation in inclusive education is needed to accommodate the various needs of students.
To produce effective evaluation content, especially in the inclusive learning process, teacher independence and creativity are needed (Sumandya et al., 2023); (Yuwono, 2017). (Sanusi et al., 2021) define teacher independence as the ability to make pedagogical decisions independently without excessive dependence on external guidance. With independence, teachers can be more courageous in doing things that are innovative and creative so that the education or learning process will encourage students to study more diligently so that it has an impact on improving the quality of education (Muslimin, 2020); (Rachmadyanti & Wicaksono, 2016). The characteristics of independence include analyzing mathematics learning needs, formulating goals, and designing learning programs, choosing and implementing learning strategies, monitoring and self-evaluating whether strategies have been implemented correctly, checking results (process and product), and reflecting to obtain feedback (Nurhayati, 2017); (Sumarmo, 2004). (Julrissani et al., 2020) emphasized that creative teaching strategies allow teachers to develop innovative evaluation models that adapt to diverse learning needs. (Murdiana et al., 2020) further argues that creative teachers are better able to apply alternative evaluation methods, create a more inclusive learning environment, and create a more inclusive learning environment. Teachers must demonstrate a high degree of originality in their teaching (Rindiantika, 2021). The expression of teacher creativity can be applied to the use of new resources to facilitate learning without having to create something completely original (Iskandar et al., 2023); (Rindiantika, 2021). However, there is still a research gap in understanding how teacher independence and creativity can be systematically utilized to improve evaluation in inclusive mathematics learning (Purwandari et al., 2024); (Suarsana et al., 2018); (Yuliani et al., 2024).
One promising framework for improving evaluation practices and aligning with the goals of inclusive education is Design Thinking (Pratiwi & Suchahyani, 2024). Design Thinking is an innovative approach that integrates multiple perspectives and is human-centered as a user to solve and find practical solutions to problems (Kelley & Brown, 2018); (Jia et al., 2023). In education, Design Thinking has been growing as an innovative approach to solving problems creatively and effectively. This approach is important because it encourages students to think critically, empathically, and solutively, and develop collaboration skills that are useful in facing real-world challenges (Hartawan et al., 2024); (Sastradinata, 2023). When in the context of education, the concept of Design Thinking is then simplified as the Design for Change (DfC) approach (Sastradinata, 2023); (Putra, 2022). Philosophically, the concept of Design Thinking with the DfC approach helps teachers hone student leadership in learning as needed (Iman et al., 2021). The implementation of the Design Thinking concept with the DfC approach uses the Feel, Imagine, Do, and Share pattern or commonly abbreviated as FIDS from learning activities that focus on content and process not just results (T. M. Nasir et al., 2023); (Putra, 2022). (Wyrwicka & Chuda, 2019) describe DfC as a collaborative problem-solving process that encourages students to explore innovative solutions through

four main stages: feel, imagine, do, and share. The development of mathematics learning evaluation with the concept of Design Thinking with the DfC approach invites students gradually to think from the heart (feel), visualize changes (imagine), realize changes (do), and share to inspire (share) (Fitroh & Mayangsari, 2017); (Iman et al., 2021); (Nailasariy, 2024). (Tinanoff et al., 2019) argue that DfC provides an effective structure for aligning learning objectives, teaching methods and evaluation strategies in an inclusive environment.. Furthermore, research by (T. M. Nasir et al., 2023) showed that the integration of the DfC approach can improve 21st century skills, social-emotional development, and academic achievement that can empower students including students with special needs. When students with special needs are empowered, they will do well and behave, so inclusive education requires Design Thinking as a systematic thinking process and methodology that prioritizes student involvement in the learning design process (Lilly, 2021). However, despite its great potential, there is a lack of empirical evidence on the effectiveness of DfC-based evaluation frameworks in inclusive vocational schools.

Existing studies on mathematics evaluation in inclusive education mostly focus on academic institutions such as junior high and senior high schools as in the research conducted by (Divayana et al., 2017) dan (Sumandya et al., 2023). In contrast, vocational schools in Indonesia, known as SMK Centers of Excellence, emphasize applied learning and work readiness, which require a different evaluation approach (Kemendikbud, 2021). Mathematics in the vocational schools curriculum has a role as a supporting subject for expertise, so conventional evaluation methods are still inadequate in meeting the demands of inclusive vocational education (Sumandya et al., 2021); (Fajra & Novalinda, 2020). In addition, the integration of Design Thinking principles into evaluation practices is less explored, particularly in the context of SMK Centers of Excellence (Widana, 2022). DfC as a unique approach helps teachers implement meaningful learning and invites students to explore life according to their potential (I Putu Pasek Suryawan et al., 2021). The DfC approach is a simpler process than PBL, PjBL, or discovery learning (Mahayukti & Dewi, 2022); (Pujawa et al., 2022); (I Putu Pasek Suryawan et al., 2022); (I P P Suryawan, 2018), that's why this evaluation is appropriate for vocational school in inclusive schools to produce work-ready graduates. Based on this description, it is important to pay attention to the evaluation of mathematics learning, this is also in line with the previous description that in evaluating, especially evaluating mathematics which is often considered a scourge by students, it is abstract, needs creativity, independence, and understanding (Lutvaidah & Hidayat, 2019); (Sriyanto, 2017).

This research aims to address this gap by developing an evaluation model for Design Thinking-based mathematics learning with the DfC approach in inclusive vocational schools. Specifically, this study aims to obtain an accurate and comprehensive picture of teachers' independence and creativity in developing mathematics learning evaluation with the DfC concept. With the findings of this research, this study aims to contribute to the development of a more equitable and effective inclusive evaluation methodology in the scope of vocational education, especially in Vocational Schools labeled as Centers of Excellence

RESEARCH METHODOLOGY

Research Design

This type of research is a mixed method that combines quantitative and qualitative methods in one study or across several related studies, through an explanatory design approach (Dawadi et al., 2021). This research certainly collects and analyzes quantitative data first, then to clarify and deepen the research, qualitative data analysis is carried out (Morgan, 2017). This study aims to obtain an accurate and comprehensive picture of teachers' independence and creativity in developing Design Thinking-based mathematics learning evaluation with DfC approach in vocational schools labeled as center of excellence schools in Bali province. Therefore, the exogenous variables in this study are the understanding of the concept of Design Thinking through the DfC approach and the concept of learning evaluation, while the endogenous variable is teacher independence with teacher creativity as a mediating variable.

Sample and Data Collection

Sampling was conducted on vocational school mathematics teachers labeled as centers of excellence in Bali province using cluster random sampling technique. Thus, the quantitative method has 114 research samples out of 159 people consisting of 27 schools constituting the population of mathematics teachers. In the qualitative method, there were 2 mathematics teachers as research subjects determined using purposive sampling technique who were representatives of several vocational schools labeled as center of excellence schools in Bali province. The research instrument used to collect quantitative data was a closed questionnaire instrument. Qualitative data collection was conducted by interviewing research subjects to deepen the analysis of the results of quantitative methods. The questionnaire instrument consisted of statements about mathematics teacher independence, teacher creativity, understanding the concept of learning evaluation, and the DfC approach. The questionnaire was measured using a five-point Likert scale with criteria, namely 1: Strongly Disagree; 2: Disagree; 3: Neutral; 4: Agree; 5: Strongly Agree. To measure the predictions of math teacher respondents, a questionnaire instrument was used which consisted of several indicators. The variable of teacher understanding of the DfC approach is an independent variable measured through several indicators, as shown in Table 1 below (Sumandya et al., 2023).

Table 1. Dimensions and Indicators of Instrument Understanding
The Concept of Design for Change Approach

Dimensions	Indicators
Assessment development procedure	Grid development skills Item writing skills Item analysis skills
Ability to collaborate with peers	Discussed with the math teacher Exploring information from peers Working in a team
Self-development	Participate in training, workshops, IHT on assessment development Active in learning community/MGMP activities Seeking information independently through various sources

The instrument for understanding the DfC approach in Table 1 has been modified into several sections, namely: assessment development procedures; skills in the learning process, ability to collaborate with peers; self-development; competency improvement. Furthermore, on the variable of understanding the concept of learning evaluation, measured through several indicators from (Nikmah, 2022) as shown in Table 2 below.

Table 2. Dimensions and Indicators of Learning Evaluation Concept Understanding Instrument

Dimensions	Indicator
Planning	Technique for constructing a grid Mastering the rules of writing question items Item analysis techniques
Implementation	Implementation Involving parents Scoring technique
Evaluation	Decision-making Determination of follow-up

The instrument for understanding the concept of learning evaluation in the table above has been modified into several parts, namely: evaluation planning; evaluation implementation; decision making; and determination of follow-up. The teacher independence variable, which is an endogenous variable, is measured through two dimensions, namely self-understanding and the situation faced and self-regulation.

Table 3. Dimensions and Indicators of the Mathematics Teacher Independence Instrument

Dimensions	Indicators
Self-understanding and the situation at hand	Recognize qualities, interests and challenges faced Develop self-reflection
Self-regulation	Emotion regulation Setting goals, achievements, self-development, and strategic plans to achieve them Showing initiative and working independently

	Develop self-control and discipline Be self-confident, resilient and adaptive

The teacher independence instrument has been modified into several sections, namely: self-understanding; understanding the situation at hand; self-regulation; showing initiative and working independently; and being confident, resilient and adaptive. In addition, this research variable is influenced by a mediating variable, namely teacher creativity. The dimensions used to measure teacher creativity are the 4Ps (Person, Process, Product, and Press).

Table 4. Dimensions and Indicators of Mathematics Teacher Creativity Instrument

Dimensions	Indicators
Person	Able to view problems from various aspects Have a good sense of curiosity Open to everything new Insightful Can appreciate the work of others
Process	Preliminary stage Preparation stage Illumination stage Verification stage
Products	New, unique, useful, and of value Heuristic
Press	Sensitivity in action Freedom of action Strong commitment to change Optimistic and risk-taking Diligent in practicing Considering problems as a means to be practical A conducive environment that is not rigid and authoritarian

Furthermore, the teacher creativity instrument in the table above has been modified into several parts, namely: the dimensions and indicators are modified into several parts, namely personal, process, product, driver, and self-commitment.

Procedure

Before the research was conducted, the activities carried out were focus group discussions to obtain preliminary information that would be the basis for preparing the research. The first procedure of this research was carried out with quantitative methods to obtain research data using questionnaires as a supplement. Therefore, to deepen the results of quantitative analysis, a qualitative method was carried out which began with data collection through observation, document study, interviews, focused observation, and selected observation (Sumandya et al., 2023). Activities are carried out by observing and listening to information directly from informants to gain an in-depth understanding of the object of research. Furthermore, taxonomic analysis, componential analysis, and theme analysis were conducted. The analysis was carried out by detailing, classifying, seeing relationships and differences, looking for relationships between dominants so as to obtain a deep understanding of the object of research. The research procedure can be described in Figure 1.

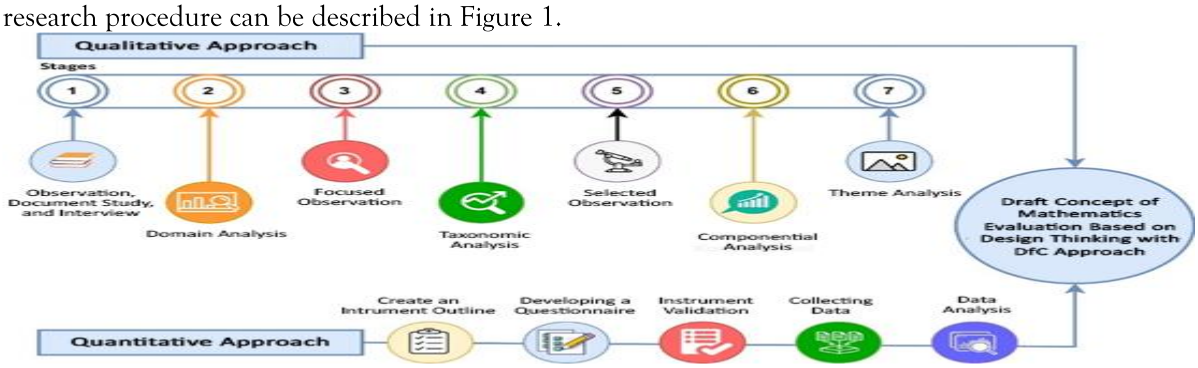


Figure 1. Research Stages

Data Analysis
Data analysis uses 2 techniques, to analyze data from a quantitative approach and analyze data from a qualitative approach. For the qualitative approach using descriptive analysis by displaying the results of mathematics teacher interviews and the results of student answers that are considered unique to represent the characteristics of the research subjects. While the data analysis technique for the quantitative approach uses the PLS SEM method. This analysis is a multivariate statistical analysis that estimates the influence between variables simultaneously with the aim of prediction, exploration or structural model development studies (Hair et al., 2019). Model evaluation in SEM PLS consists of measurement models, structural model evaluation and evaluation of model goodness and fit.
Test Validity and Reliability
The validity and reliability of the research were evaluated using a reflective measurement model, based on criteria including factor loadings ≥ 0.70, composite reliability (CR) ≥ 0.70, average variance extracted (AVE) ≥ 0.50, and Cronbach's Alpha ≥ 0.70. Discriminant validity was assessed using the Fornell-Larcker criterion and the Heterotrait-Monotrait Ratio (HTMT), with a threshold of <0.90. The DfC approach variable was measured with 4 valid indicators (loadings 0.775–0.855), with CR = 0.886, Alpha = 0.828, and AVE = 0.661; DfC1 (Assessment development procedure with DfC approach) and DfC3 (Self-development) were the strongest indicators.
The Learning Evaluation Concept (LEC) variable was measured by 5 items (loadings 0.801–0.841), with CR and Alpha values above 0.70 and AVE = 0.658; LEC3 (Learning evaluation supervision) had the highest loading. Teacher Creativity (CT) had 5 valid indicators (loadings 0.717–0.803), CR = 0.869, Alpha = 0.812, and AVE = 0.571, with CT3 (Teacher-generated products) and CT4 (Teacher drivers in developing evaluation) as the most prominent items. Teacher Independence (IT) was measured with 5 items (loadings 0.730–0.820), CR = 0.884, Alpha = 0.836, and AVE = 0.603; the strongest indicators were IT2 (Understanding the situation at hand) and IT3 (Emotion regulation). Discriminant validity was confirmed as all constructs met the Fornell-Larcker criterion, with AVE roots exceeding inter-construct correlations, and HTMT values below 0.90, indicating that all variables are conceptually and statistically distinct. With these requirements fulfilled, the structural model can be evaluated for hypothesis testing.

RESULT
Quantitative Result with SEM-PLS Method
The structural model evaluation check consists of checking whether or not there is multicollinearity between variables using the VIF (Variance Inflated Factor) value <5 with a 95% confidence level of the estimated path coefficient parameters. The effect of direct variables at the structural level is a direct effect with an f square value (f square 0.02 low category, 0.15 moderate category, 0.35 high category). As for the mediation effect using the upsilon v statistical measure obtained from the square of the mediation coefficient, according to Lachowics, et al (2018) interpreted in (Ogbeibu et al., 2024) said that the low mediation effect is worth 0.02, the moderate mediation effect is 0.075, and the high mediation effect is worth 0.175. The overall evaluation of the model consists of R Square and Chin's (1998) criteria, namely, a low influence of 0.19, a moderate/moderate influence of 0.33 and a high influence of 0.66 and a Q Square value above 0. Test the fit of the model with SRMR <0.08. (Hair et al., 2019) or Karin Schmelleh et al (2003) criteria say that the SRMR value is 0.08 - 0.10 (acceptable fit). PLS Predict to evaluate the predictive power of the PLS model as indicated by the RMSE and MAE PLS is lower than the linear regression model.
The evaluation results of the structural model show that the model is acceptable, namely there is no multicollinearity between variables indicated by VIF < 5, the estimated parameters are robust. Based on the results of the data processing above, it can be said that the joint effect of the DfC approach and the concept of learning evaluation on teacher creativity is 61.9% (the effect is close to high) and the remaining 38.1% cannot be explained by exogenous variables. The magnitude of the influence of understanding the DfC approach, the concept of learning evaluation, and teacher creativity on teacher independence is 59.8% (moderate influence approaching high). Q Square value is a measure of validity in PLS to state the suitability of model predictions. The Q Square value of the model gets a value above 0, so it has predictive relevance (Hair et al., 2019). The SRMR value of the model is obtained from the output results of the

goodness of fit section, which is 0.101, which means it is still in an acceptable fit. Table 5 can be presented to clarify this research.

Table 5. Path Coefficients on Direct Effect

Hypothesis	Beta (β)	t-values	p values	97.5% CI	Report	R^2	f^2	VIF	Q^2
Direct Influence									
DfC → KG	0.434	4.349	0.000	[0.233, 0.624]	Support	0.619	0.316	1.565	0.580
EP → KG	0.445	4.587	0.000	[0.255, 0.633]	Support		0.332	1.565	
DfC → KemG	0.283	2.580	0.010	[0.067, 0.500]	Support	0.598	0.097	2.059	0.464
EP → KemG	0.083	0.708	0.479	[-0.138, 0.317]	Unsupportive		0.008	2.084	
KG → KemG	0.484	3.778	0.000	[0.223, 0.719]	Support		0.223	2.622	
Indirect Influence / Mediation									
DfC → KG → KemG	0.210	2.755	0.006	[0.080, 0.377]	Support	-	0.0441	-	-
EP → KG → KemG	0.215	2.862	0.004	[0.082, 0.373]	Support		0.0662	-	

Note: DfC: Approach Design for Change; EP: Learning Evaluation Concept; KG: Teacher Creativity; KemG: Teacher Self-Reliance

Based on the results of hypothesis testing above, the following results are obtained.

The first hypothesis is accepted, showing a significant effect of the DfC approach on teacher creativity ($\beta = 0.434$, $p = 0.000 < 0.05$). At a 97.5% confidence level, the effect ranges from 0.233 to 0.624, indicating a moderate-to-high impact (structure level = 0.316). Enhancing teachers' understanding of the DfC approach is crucial, as school policies supporting it could increase teacher creativity by up to 62.4%.

The second hypothesis is accepted because there is a significant effect of understanding the concept of learning evaluation on teacher creativity with a path coefficient (0.445) and p-value (0.000 <0.05). This means that any change in teachers' understanding of the concept of evaluation will increase teacher creativity. At the 97.5% confidence level, the effect of learning evaluation ranges from 0.255 to 0.633. Thus, understanding the concept of evaluation in improving teacher creativity has a moderate effect close to high in the structure level of 0.332 so that increasing the understanding of the concept of evaluation is very important for teachers to implement.

The third hypothesis is accepted, there is a significant effect of understanding the DfC approach on teacher independence with a path coefficient (0.283) and p-value (0.010 <0.05). This means that any change in teacher understanding of the DfC approach will increase teacher independence. In the 97.5% confidence level, the influence of learning evaluation ranges from 0.067 - 0.500. Thus, the understanding of the DfC approach in improving teacher independence has a low influence approaching moderate in the structure level of 0.097. Thus, understanding the DfC approach affects the increase in teacher independence in developing mathematics learning evaluations.

The fourth hypothesis is rejected because there is an insignificant effect of understanding the concept of evaluation on teacher independence with a path coefficient (0.083) and p-value (0.479 > 0.05). This means that any change in teachers' understanding of the concept of evaluation will reduce teacher independence. At the 97.5% confidence level, the effect of learning evaluation ranges from -0.138 to 0.317. Thus, understanding the concept of evaluation in improving teacher independence has a very low influence in the structure level of 0.008. Thus, understanding the concept of evaluation requires a deeper understanding with the support of other indicators that increase the path coefficient between variables.

The fifth hypothesis is accepted, there is a significant effect of understanding teacher creativity on teacher independence with a path coefficient (0.484) and p-value (0.000 <0.05). It means that any change in teacher creativity will increase teacher independence. At the 97.5% confidence level, the effect of creativity on teacher independence ranges from 0.223 to 0.719. Thus, teacher creativity in improving teacher independence has a moderate effect close to high in the structure level of 0.223. Thus, teacher creativity influences increasing teacher independence in developing mathematics learning evaluations.
The sixth hypothesis is accepted, teacher creativity significantly mediates the effect of the DfC approach on teacher independence (coefficient = 0.210, p = 0.006 < 0.05). Though the mediation effect is still low (upsilon v = 0.441), it could rise to 37.7% with improved creativity (Ogbeibu et al., 2024). Creativity supports understanding of evaluation concepts and boosts teacher independence. The DfC approach using FIDS (Feel, Imagine, Do, Share) relies on teacher creativity to engage students and nurture their interests. The seventh hypothesis is accepted where teacher creativity significantly acts as a mediating variable, namely mediating the indirect effect of the evaluation concept on teacher independence with a mediation path coefficient (0.215) and p-value (0.004 <0.05). However, at the structural level, the mediating role of creativity is still classified as a low mediating effect (upsilon v = 0.662) according to (Ogbeibu et al., 2024). In the 97.5% confidence interval, by increasing the improvement of teacher creativity, this mediating role will increase to 37.3%. Therefore, creativity can help the understanding of evaluation concepts and influence teacher independence.
(Hair et al., 2019) state that PLS is an SEM analysis with predictive purposes. Therefore, it is necessary to develop a measure of the form of model validation to show how good the predictive power of the proposed model is by presenting PLS Predict which works as a form of validation of the strength of the PLS prediction test.

Table 6. Out of Sample Predictive Power Analysis

Indikator	PLS-SEM_RMSE	PLS-SEM_MAE	LM_RMSE	LM_MAE
KG1	0.575	0.425	0.615	0.432
KG2	0.626	0.490	0.694	0.539
KG3	0.503	0.395	0.521	0.379
KG4	0.759	0.573	0.500	0.287
KG5	0.852	0.681	0.648	0.406
KemG1	0.674	0.529	0.664	0.501
KemG2	0.938	0.744	1.026	0.810
KemG3	0.888	0.678	0.998	0.758
KemG4	0.700	0.496	0.718	0.518
KemG5	0.648	0.490	0.593	0.382

Note: KG: Teacher Creativity; KemG: Teacher Independence

Overall based on data processing, all RMSE and MAE values, the PLS model is lower than the linear regression model, so the model has high predictive power. The results of the structural model can be presented as follows.

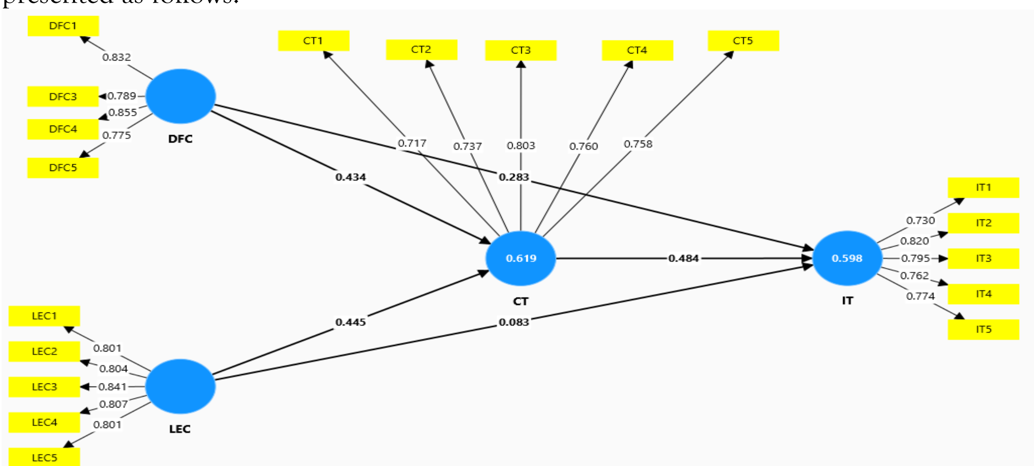


Figure 2. Final Model

Referring to Figure 2, it can be seen that the structural model of the quantitative results with the SEM PLS method presents the magnitude of each path coefficient on the research variables. From the results of the initial analysis, it was found that item DfC 2 (skills in the learning process) had a path coefficient value of less than 0.70, so item DfC 2 (skills in the learning process) could be removed from the model. The figure above is the result of re-estimation by eliminating item DfC 2 (skills in the learning process). The results of the quantitative analysis have been well described, next we will explain the results of the analysis through in-depth interviews and documentation of unique answers of vocational school students labeled as centers of excellence.

Qualitative Results

Integration of Design for Change in the Evaluation of Inclusive Mathematics Learning in Vocational School Center of Excellence

This case study shows how teachers integrate the Design for Change (DfC) approach into math evaluations to include students with special needs. The findings support SEM-PLS results indicating that DfC indirectly enhances teacher independence and creativity. Rooted in Design Thinking, DfC promotes innovation and change in both teaching and learning (Lin, 2021). Interviews with teachers at Excellence Center vocational schools revealed that while many apply DfC unconsciously, they recognize it as a way to boost student participation and problem-solving, as the following quote.

"*Without knowing the theory first, must of the Design Thinking and Design for Change approaches have been implemented in this school through project-based learning and assessment. We also consider the diversity of inclusive students in the preparation of evaluations used both formative and summative.*"

Some teachers also explained that they had implemented the Design for Change steps in learning in inclusive classrooms. The results of the teacher interview quotes are stated as follows.

"I have participated in training on the development of differentiated evaluation for inclusive schools, I started DfC with the stages of recognizing student problems and material context, then designing solutions and selecting evaluation forms according to student needs."

"The DfC stage not only makes students more active in connecting math concepts with practice, fellow students also understand each other's feelings and increase their empathy for students with special needs"

Design for Change-based evaluations allow students in inclusive schools to apply mathematical concepts in real projects related to their areas of expertise. In vocational schools that include mechanical engineering, accounting and architecture majors such as Senior Vocational School number 3 Singaraja and Bali Mandara Vocational School, the application of learning is carried out by combining the Design for Change approach with Project Based Learning (Jia et al., 2023); (Putra, 2022).

"I try to apply project-based evaluation according to students' majors, such as asking students to analyze financial statements in cooperatives in Accounting majors. The obstacle that often hinders is that not all materials can be evaluated in this way, but are still tested through written tests with relevant contexts."

In the midst of complex vocational mathematics materials, teachers' demands to create skill-centered evaluations sometimes run into obstacles. Not all materials can be presented in the form of projects such as basic algebra, logarithms, or probability, so they are more effectively evaluated through written tests (Marsiti et al., 2023); (Sumandya et al., 2023); (Pujawa et al., 2022). However, written tests can still be constructed in contexts relevant to students' majors. This indicates that mathematics teachers in vocational schools labeled as Centers of Excellence have a great desire to develop their potential. Teachers' understanding of the Design Thinking approach based on Design for Change is high as seen from the questionnaire results, although there are still some teachers with a moderate level of understanding. Here is one quote from a teacher who does not clearly understand the Design for Change approach.

"Teachers in this school are mostly senior and we find it difficult to develop inclusive evaluations based on Design for Change because we do not fully understand this concept. We in this school are used to the existing traditional assessment methods. To change this perspective may require more time and training."

The results of these interviews suggest that it is important for schools to provide continuous training and adequate support to teachers so that they can better understand and implement the Design for Change approach.

Understanding the Concept of Mathematics Learning Evaluation in Vocational School Center of Excellence

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. xx No. x, 2025
https://www.theaspd.com/ijes.php

Vocational school teachers' understanding of the basic concepts of learning evaluation is in the high category. Most teachers have conducted evaluation planning according to the applicable assessment standards, including the preparation of evaluation forms that suit student needs, question cards, and item analysis stages. Teacher interview quotes state the following.

"Inclusion students have different ways of learning, so the evaluation must also be customized. My understanding of Design for Change, which is similar to differentiated learning, helps me to create evaluations that don't overwhelm students. I often use portfolios or project-based assessments to see their progress more tangibly."

Teachers with strong motivation and training in inclusive evaluation can give constructive feedback and use diverse methods like Q&A, interviews, discussions, presentations, portfolios, and projects—especially in Excellence Center vocational schools (Susiani et al., 2022). Assessments for students with special needs should align with their cognitive abilities. While some students can handle similar questions as regular peers, students with intellectual disabilities (like Tunagrahita) need more contextual, image-based problems. However, many teachers have yet to fully adapt evaluations to varying cognitive levels

A child who is 1.5 m tall flies a kite whose thread is 15 m long. If the angle formed between the kite's flying thread and the horizontal line is 30°, then the height of the kite from the ground is....

Figure 3. Questions for Inclusive Students

From the question above, the answers obtained from inclusive students who worked on the evaluation questions were as shown in Figure 4 below.

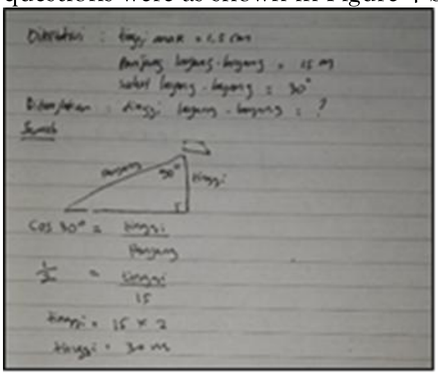
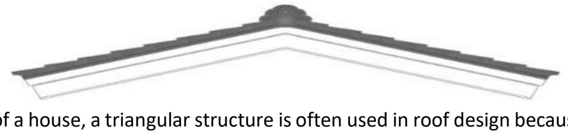


Figure 4. Answers to Evaluation Questions for Inclusion Students

Analysis of students' answers, especially inclusion and regular students, found that inclusion students are still often wrong in making image projections and do not utilize all the information available. For regular students, this problem can generally be handled easily, but children with special needs are still often mistaken in pouring problem information into their answer sheets. As a result, the students' final answers are also wrong.

The results of the analysis of students' answers need to be a concern for teachers in developing learning evaluations that support teachers' abilities. The shortcomings of the evaluation approach have been optimized by teachers with a high understanding of Design for Change and evaluation concepts. Some of them have packaged their evaluations according to the category of students with special needs. The evaluation questions they designed for regular students are presented in Figure 5 below.



In the construction of a house, a triangular structure is often used in roof design because it is stronger than other shapes. An architect wants to make a roof frame in the shape of a side frame with a height of 5 meters and an angle between the sloping side and the base of the roof of 300. The sloping side of the frame will be installed with roof tiles measuring 50 cm long. How many tiles can be filled on one of the side frames of the roof?

Figure 5. Mathematics Evaluation Problem for Regular Students

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. xx No. x, 2025
https://www.theaspd.com/ijes.php

For students with special needs, the questions presented by the teacher can be seen as Figure 6 below

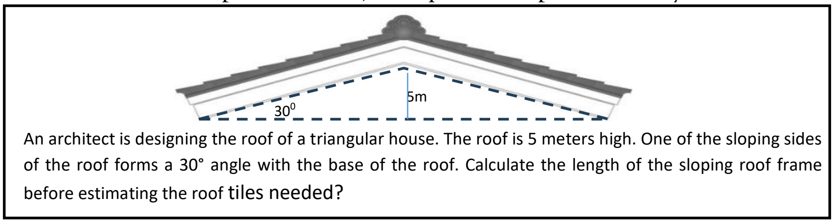


Figure 6. Mathematics Evaluation Problem for Inclusive Students

The problems presented to the two students both use a contextual approach that involves students' daily lives to help them understand the concept of trigonometric comparison in use. The level of the problem level, illustration assistance is also considered in detail by the teacher so that students can translate the meaning of the existing problems. In the evaluation process, sometimes students are given a grid to help them find answers. The results of the answers of regular and special needs students after being given evaluation questions with different levels are presented in Figure 7 below.

Regular Student Answers **Inclusion Student Answers**

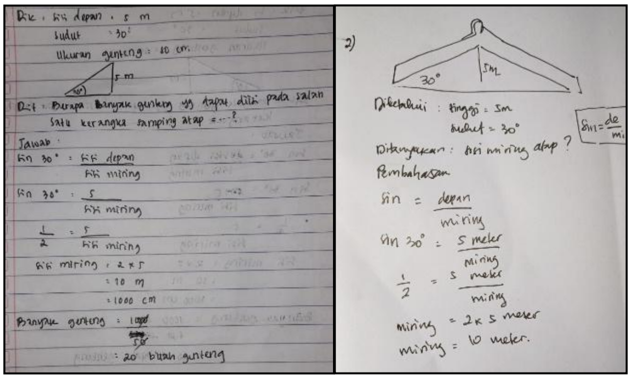


Figure 7. Regular Math Answers and Students with Special Needs

Outcomes and evaluation approaches capable of serving all students in inclusive schools led teachers to immediately develop an understanding of the Design for Change approach beyond their innovative capabilities. Most teachers in vocational schools of centers of excellence are innovative in developing evaluation forms, but some teachers prefer to use test questions that are already available in the textbook or questions from the previous year. Here's an excerpt from his interview;

"Textbooks are usually tailored to the curriculum and exam standards. So, the questions that are there are already very relevant to what students need to learn. The previous year's exam questions also provide an advantage for students because they can understand the pattern of questions that often appear in the exam."

The results of these short interviews show why some teachers choose to use exam questions from the textbook or previous year's questions. They feel this approach provides good preparation for students and is in line with existing curriculum standards.

Independence of Mathematics Teachers at Vocational School Center of Excellence

The difference between teachers in regular vocational schools and vocational Centers of Excellence can be seen from the role of teachers, where vocational school teachers in Centers of Excellence as model schools demand teacher independence in managing learning. Not only teaching in class, but teachers are also actively involved in curriculum development, preparation of exam questions, and lesson planning in accordance with industry needs with fellow vocational schools, industrial partners and Subject Teacher Consultation (in Indonesia is known as MGMP) in each district. The math teacher here uses the latest technology to support the teaching and learning process as well as evaluation, such as educational software (Zoom, Canva), e-learning platforms, and digital learning tools, as conveyed by the teacher in the following quote.

"Technology is very helpful. I use various learning platforms and software to create questions that not only include multiple-choice items but also require students to analyze data. This aims to prepare students for the challenges of an increasingly dynamic workforce and supports different learning styles."

Although math teachers are highly independent in managing learning, they also value collaboration, especially in developing teaching materials and exam questions. Close collaboration between teachers and parents is crucial in creating an inclusive learning environment and supporting the development of each student, especially those with special needs. With open and regular communication, teachers can more easily adjust teaching methods and evaluations to meet the students' needs, ensuring that every student has an equal opportunity to learn and grow.

The Creativity of Mathematics Teachers at Vocational Schools of Excellence

Teacher creativity in developing assessments at Vocational Schools of Excellence is shown through varied and innovative methods like observations, interviews, practical tests, and projects. While some teachers still use conventional tests, highly creative teachers design diverse evaluations to meet inclusive students' needs. This innovation stems from training and workshops provided by Excellence Center schools. Below is an interview excerpt from a mathematics teacher:

"I use several variations of approaches for evaluating inclusive students in mathematics, such as observation, interviews, and contextual practical tests. The approaches used are the same as for regular students, but the difficulty level of the material and questions is adjusted to be different, of course, made easier."

The development of teacher creativity in Vocational Schools of Excellence faces several challenges, where not all teachers can implement these varied evaluation methods. The main issue encountered is the difficulty in designing evaluation questions that align with the needs of students, especially for students with special needs. These students require adjustments in the form of questions, language, and the delivery of evaluations to make them easier to understand, which can be addressed through increased training and workshops attended by the teachers.

DISCUSSION

Mathematics teachers at vocational schools with the Excellence Center label in Bali show strong understanding of the DfC approach and learning evaluation, which significantly boosts their creativity. While DfC also supports independence, the evaluation concept alone has less impact. Creativity serves as a key factor linking DfC and evaluation understanding to teacher independence. Thus, fostering creativity through DfC is essential for promoting both independence and student motivation (Ziadat & Sakarneh, 2021). The integration of the Design Thinking concept, which is derived into the DfC approach, brings about a process of change and innovation in learning at vocational schools with the Excellence Center label (Lin, 2021). The basic principles of the Design Thinking concept and DfC encourage teachers to develop more creative mathematics learning evaluation methods that can facilitate critical and collaborative problem-solving among students.

According to the results of the SEM PLS model, the understanding of Design for Change has a significant impact on both teacher independence and creativity, both directly and indirectly. This enables teachers who understand and apply the concepts of Design Thinking and DfC to better adapt to the dynamic changes and needs of education, especially in the context of evolving mathematics evaluation. The results of this study are also in line with the research by (Azizah, 2024), which emphasizes that Design Thinking has the potential as a creative approach that can drive positive change and contribute to the development of innovative learning in the digital era. This is further supported by (Lin, 2021) research, which reveals that the DfC approach has proven effective in supporting the application of DfC in the field of education.

Inclusive evaluations in vocational schools can be adapted to meet the needs of students with intellectual (tunagrahita) and physical (tunadaksa) disabilities. Students with intellectual disabilities struggle with abstract thinking and problem-solving (Wulandari, 2016), while those with physical disabilities face movement challenges but can learn with assistive tools (Nurhayati, 2017). Effective evaluations should motivate all students and accommodate their needs, which teachers address by involving them in designing assessment rubrics during the Design phase. This aligns with (Arlina, 2016), who emphasized inclusive practices in vocational schools to support students with special needs.

The application of the DfC concept with the stages of Feel, Imagine, Do, and Share provides an inclusive framework for preparing mathematics learning evaluations in inclusive schools at the vocational school level with the Excellence Center label (Wyrwicka & Chuda, 2019). Each stage in the DfC process not only facilitates a more interactive and meaningful teaching and learning process but also empowers students with special needs to actively participate and feel valued in the learning environment (Wongdee, 2019). In the Feel phase, both teachers and students collaboratively identify challenges and needs in mathematics learning (Lin, 2021); (Suharta & Astawa, 2024). Next, in the Imagine phase, students are encouraged to imagine and design creative solutions to overcome the challenges that have been identified (Razali et al., 2022). In the Do phase, the solutions that have been designed are implemented, and in this stage, students with special needs are involved in the execution of the solutions, allowing them to experience the direct impact of their contributions (Lin, 2021). Finally, in the Share phase, students share their experiences and the outcomes of the solutions they have implemented, including students with special needs, who are also given the opportunity to showcase their achievements to the school community and their parents. This helps enhance their sense of appreciation and recognition for their abilities (Wyrwicka & Chuda, 2019).

Using Design Thinking with the DfC approach allows inclusive vocational schools to create fair, empowering math evaluations where all students can grow and contribute (Khayankij, 2024; Phonhan, 2016). This aligns with (Satria & Muntaha, 2022), who highlight how Design Thinking fosters creativity, collaboration, and problem-solving through the stages of Feel, Imagine, Do, and Share, supporting more interactive and inclusive assessments. The DfC approach boosts teacher and student creativity and independence through collaboration in designing evaluations (Nicholson et al., 2022; (Hendrik Dewantara, 2024). Teachers at Excellence Center vocational schools benefit from training that enhances self-management and initiative, supporting findings by (Mea, 2024) and the Bali Early Childhood Education Center (2024) on technology's role in skill development. Younger teachers adapt more easily to DfC, while older ones need more time and targeted training (Sumandya et al., 2023). Broader training is needed beyond vocational contexts to develop diverse evaluation tools (Bosch et al., 2024).

Each concept of developing learning evaluations certainly has its own limitations. The Design Thinking concept with the DfC approach requires a shift in school culture, which may face resistance from teachers, students, or other stakeholders accustomed to traditional evaluation methods (Steen et al., 2023). This change requires support and commitment from all parties in the school. Teachers, who play a role in designing learning evaluations, need reinforcement on the basic concepts of developing mathematics learning evaluations based on Design Thinking and the DfC approach through routine training or workshops. Training on the Design Thinking concept with the DfC approach aims to provide teachers with an understanding and experience in using Design Thinking methods to solve complex educational problems through problem identification, searching for effective solutions, and iterating those solutions (Reinholz & Andrews, 2020). The new knowledge teachers gain about the Design approach is expected to be applied to produce effective learning evaluation products, especially in inclusive schools, that can accurately measure what needs to be measured through the evaluation process.

CONCLUSION

The data analysis obtained from the SEM PLS model and the results of teacher interviews indicate that the understanding of mathematics teachers in inclusive vocational schools with the Excellence Center label regarding the DfC concept influences their independence and creativity in the development of mathematics learning evaluations, both directly and indirectly. The development of mathematics learning evaluations based on Design for inclusive schools not only makes the evaluation process more innovative but also provides opportunities for students with special needs to participate in the learning process. The understanding of the Design Thinking approach based on DfC bridges the gap for teachers to channel their independence and creativity to accommodate the diverse needs and learning styles of inclusive students. In the future, the integration of Design Thinking with the DfC approach is essential, not only for all vocational school teachers but also for elementary and secondary schools. This will enhance their ability to evaluate mathematics learning, ensuring that inclusive students are well-facilitated in their learning in line with the core principles of mathematics education, as seen in vocational schools labelled as Center of Excellence.

ACKNOWLEDGMENT

This research is a basic study funded by the Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia. Through this work, the researcher expresses gratitude to the Directorate of Research, Technology, and Community Service (DRTPM) of the Ministry of Education and Culture for the opportunity and funding for this research, the Institute for Research and Community Service (LPPM) of Ganesha University of Education for the opportunity and research permission, the vocational schools labelled as Center of Excellence in Bali Province for their willingness to be the research site, and the Mathematics teachers at the Vocational School of the Excellence Center. The researcher would also like to express thanks to the students of the inclusive vocational School that labelled as Center of Excellence school in Bali Province for their willingness to participate as subjects of this research. With the help and support from these parties, this research was able to proceed smoothly and produce credible findings that impact the mathematics learning process.

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