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Vocational teachers' autonomy in developing problem-based mathematics learning evaluation integrated with the design for change

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Abstract. Teachers' experience and autonomy in designing evaluations often overlook the needs of students with special needs, a key component of inclusive education in vocational high schools. The integration of the Design for Change (DfC) approach, a component of design thinking, is regarded as a relevant approach to bridge mathematics learning with both inclusivity and industry relevance. This study explores the impact of integrating the DfC approach supported by teachers' understanding of evaluation on the autonomy of inclusive vocational school teachers in developing problem-based mathematics learning evaluations. Using a mixed-methods approach with an explanatory sequential design, data collection began with a quantitative phase involving 114 mathematics teachers from inclusive *SMK Pusat Keunggulan* in Bali, selected through cluster random sampling. Data were analyzed using multiple linear regression and t-tests. The qualitative phase involved two purposively selected teacher informants, with data gathered via semi-structured interviews and analyzed descriptively. Findings reveal that teachers with a strong understanding of the DfC tend to show greater autonomy in designing problem-based mathematics learning evaluations aligned with both student needs and vocational demands. The DfC approach is shown to support mathematics teachers in creating innovative, inclusive, and industry-relevant evaluations.

Introduction

Inclusive schools are a component of the education system in Indonesia aimed at providing equal access to education for all students, including those with special needs. Children with special needs require educational services tailored to the learning barriers they face, whether related to psychological, physical, mental, emotional, social aspects, or a combination of these conditions, to optimize their potential (Amahoru & Ahyani, 2023; Ashari, 2021). Inclusive education also plays a role in developing the technical and practical skills needed by students, especially for children with special needs who require vocational preparation to face the workforce (Anabanu, 2021; Marlina et al., 2023). Vocational skills provision can assist children with special needs in tackling challenges in the workplace and optimizing their potential as well as the natural resources around them (Ashari, 2021; Widana et al., 2023).

The implementation of vocational learning must be supported by high-quality education that strengthens both teacher and student performance, along with industry partnerships positioning

these schools as models for others (Wahjusaputri et al., 2024). This program encourages the integration of industry-relevant vocational learning, enabling both regular and special needs students to gain not only theoretical understanding but also practical skills essential for the job market. These skills are developed through students' vocational choices and supporting subjects, with mathematics playing a critical role in reinforcing vocational school core competencies (Maimun, 2021; Widana et al., 2023).

Mathematics learning in vocational high schools has fundamental differences from that in senior high schools, where the main focus is directed towards the workforce by reflecting processes in the industry (Khofipah et al., 2023; Wahjusaputri et al., 2024). Therefore, mathematics learning in vocational high schools needs to emphasize practical skills that can be directly applied in the workplace, not merely theoretical but also applicable to the vocational needs of students (Putri, 2023; Fridayanthi, 2025). Ideal mathematics learning and its evaluation should not only assess the final results but also consider the learning process while taking into account the diverse needs of students. Differentiated and inclusive evaluation is essential to ensure that every student, including those with special needs, feels recognized, their potential valued, and facilitated according to their learning styles (Marlina et al., 2023). This contributes to greater equity in assessment and encourages student's autonomy in learning mathematics (Sakiinatullaila et al., 2020).

However, challenges in designing mathematics learning evaluations that meet student's needs generally lie in the limited capabilities of mathematics teachers themselves. Several factors hindering the development of vocational-relevant and equitable mathematics evaluations for all students include: (1) lack of literature to independently develop questions; (2) absence of training on the development of vocational-based inclusive mathematics questions; (3) scarcity of examples for vocational-based inclusive mathematics evaluations; and (4) evaluation approaches that have yet to accommodate student diversity (Citrawan et al., 2024; Widana et al., 2023).

To design effective and inclusive mathematics evaluations, teachers must possess the skills to create relevant, differentiated assessments achieved through increased autonomy. This can be done by increasing the understanding of the concept of learning evaluation through increasing teacher autonomy in carrying out tasks and functions. This teacher autonomy is defined as an attitude that is able to make decisions without always being guided by existing standards. Teacher autonomy in designing learning evaluations involves active teacher participation in planning, implementing, and reflecting on learning evaluations (Sumandya et al., 2023). Not only that, to implement effective evaluations, teachers need to understand how to create the right evaluation instruments. A good understanding of the concept of evaluation and evaluation approaches gives teachers the confidence to choose and adjust evaluations according to learning objectives and student diversity. This allows teachers to innovate independently, producing more relevant, inclusive, and meaningful evaluations (Citrawan et al., 2024; Sumandya et al., 2023).

Nevertheless, teacher's understanding of evaluation concepts alone is not sufficient to develop evaluations that are friendly and relevant for students with special needs (Sakiinatullaila et al., 2020; Widana et al., 2023). To achieve the alignment of mathematics learning with student's majors and diversity, a design in the development of mathematics learning evaluation is needed that can engage all students to become competent in mathematics topics supporting their vocational fields. A design-based approach that is relevant for creating more adaptive and inclusive evaluations can be implemented through the Design for Change (DfC) approach. The simplified DfC approach derived from design thinking is relevant in designing adaptive and inclusive evaluations (Blundell, 2022; Jia et al., 2023).

The DfC approach empowers students as agents of social change while fostering creativity and collaboration in solving real-world mathematics problems (Nailasariy et al., 2023). Through the FIDS process (*Feel*, *Imagine*, *Do*, and *Share*) students identify problems, brainstorm solutions, take action, and share outcomes for feedback. This process supports both student and teacher development. The DfC stages are especially relevant in vocational and inclusive education, as they promote empathy and understanding toward students with special needs (Amelia & Azizah, 2023; Wahjusaputri et al., 2024). As such, integrating the DfC approach into learning evaluations is essential in developing innovative, independent educators who can design meaningful and inclusive mathematics assessments at the vocational level (Blundell, 2022; Jia et al., 2023).

Teachers' autonomy in designing mathematics learning evaluations for inclusive vocational schools is a key factor in driving instructional innovation, yet it has not been fully optimized in schools. The ability to understand evaluation concepts and select appropriate learning strategies for students with special needs is essential for teachers in inclusive vocational settings (Man et al., 2022; Wilson & Hunt, 2022; Zikl et al., 2015). However, in practice, many teachers still rely on conventional evaluation methods that are less responsive to student diversity. This finding is supported by observations of evaluation practices in several inclusive vocational schools, which revealed that 60% of teachers still rely on written tests as the primary method, rather than using more innovative and participatory evaluation strategies. Conventional mathematics evaluations have several limitations, particularly for students with diverse learning styles, especially those with intellectual disabilities (Man et al., 2022; Waiyakoon et al., 2015). The dominance of written tests is often justified by the perception that they simplify the assessment process for teachers, even though this approach does not fully reflect students' competency achievements. Therefore, it is urgent to conduct further studies on this issue.

While regular vocational schools continue to face various challenges in developing adaptive learning evaluations responsive to student needs, *SMK Pusat Keunggulan*, recognized as model institutions, receive greater institutional support. These schools benefit from enhanced teacher training, capacity building, and the development of instructional strategies that are both industry-oriented and inclusive. Ideally, the strategies and autonomy of teachers in *SMK Pusat Keunggulan* should foster learning and evaluation processes that implement appropriate assessment concepts aligned with the principles of DfC (Hooijdonk et al., 2020; Tu et al., 2018).

Research that combines the DfC approach in the context of evaluating mathematics learning in inclusive and vocational education is still limited in Indonesia. Most studies focus on technical skills, while inclusive evaluation and creative methods such as DfC have not been widely explored. This research is important to support student-centered learning, where evaluation is designed to understand the background and needs of students starting from the independent abilities of teachers (Blundell, 2024; Bosch et al., 2025; Widana et al., 2023). The ability of *SMK Pusat Keunggulan* teachers to develop evaluations needs to be studied, where teachers are supported in their autonomy through access to training and collaboration with high industry. Therefore, the purpose of this study is to examine the impact of integrating DfC and teachers' understanding of evaluation concepts on the autonomy of teachers in designing problem-based mathematics learning evaluation at *SMK Pusat Keunggulan* in Bali.

Method

This study employed a mixed methods approach with an explanatory sequential design approach to explore the impact of integrating the DfC approach on teacher autonomy in developing problem-based mathematics learning evaluations in inclusive vocational schools. The study began with quantitative data collection and analysis, followed by qualitative analysis to deepen and clarify

the results (Wijaya, 2019). The sampling, data collection, instruments, and data analysis techniques for the quantitative and qualitative research in this study are as follows.

a. Quantitative Method

Slovin's formula, resulting in 114 inclusive vocational school teachers out of a total population of 159 teachers spread across 27 *SMK Pusat Keunggulan* in Bali. Data for the quantitative phase were collected using questionnaires as the main method, based on the research variables, which include questionnaires to assess teachers' understanding of the DfC approach, their understanding of evaluation concepts in problem-based mathematics learning, and their autonomy in developing mathematics learning evaluations in inclusive vocational schools. The questionnaires were measured using a five-point Likert scale with the following criteria: 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, and 5= Strongly Agree (Alwy Yusuf et al., 2024; Wijaya, 2019). The questionnaires were distributed to mathematics teachers at *SMK Pusat Keunggulan* in Bali as respondents via google forms, with the researcher initially providing technical guidance on how to complete the questionnaires at the sampled schools. Respondents were then given ample time to thoughtfully fill out the questionnaires. Understanding of the DfC approach, evaluation concepts, and teacher autonomy were explored based on the dimensions outlined in the questionnaires, as presented in Tables 1, 2, and 3 below.

Tabel 1. Grid of Understanding the DfC Approach Teachers

Dimension	Indicator
Assessment Development Procedure	Skills in designing assessments according to the FIDS steps
	Skills in writing test items according to the vocational context
	Skills in analyzing test items
The ability to collaborate with colleagues	Discussing with mathematics subject teachers
	Gathering information from students' parents
	Working in a team
Self-development	Attending training, workshops, and In-House Training (IHT) on assessment development
	Active in learning community activities/MGMP (Subject Teacher Association)
	Independently seeking information through various sources

The questionnaire grid is designed to include 20 statement items, consisting of 12 positive statements and 8 negative statements. The statements in the questionnaire are part of the dimensions and indicators that have been formulated in the grid presented in Table 1.

Tabel 2. Grid of Understanding Teacher of Problem-Based Mathematics Learning Evaluation

Dimension	Indicator
Planning	Techniques for designing a blueprint
	Mastering the rules of writing test items
	Test item analysis techniques
Implementation	Implementation
	Involving parents
	Scoring techniques
Self-development	Decision-making
	Determination of Follow-up Actions

The questionnaire grid is designed with 17 statement items, including 9 positive statements and 8 negative statements. The questionnaire statements are part of the dimensions and indicators that have been formulated in the grid presented in Table 2.

Table 3. Grid of Teacher Autonomy Indicators

Dimensio	Indicator
Self-awareness and understanding of the situation	Recognizing one's qualities and interests, as well as the challenges faced
	Developing self-reflection
Self-regulation	Emotional regulation
	Goal setting, achievement, self-development, and strategic planning to achieve them
	Demonstrating initiative and working independently
	Developing self-control and self-discipline
	Confident, resilient, and adaptive

The questionnaire grid is designed with 20 statement items, consisting of 12 positive statements and 8 negative statements. The questionnaire statements are part of the dimensions and indicators that have been formulated in the grid presented in Table 3.

The instrument, which has been reviewed by experts and revised, was subsequently pilot-tested on a limited scale to obtain the validity of the items, which were analyzed using the Pearson Product Moment test, and reliability using Cronbach's Alpha. After the data has been collected, data analysis is conducted. The researcher first performs a classical assumption test to meet the prerequisites for hypothesis analysis, with five prerequisites that have been met, namely: normality test, linearity and significance of regression direction test, multicollinearity test, autocorrelation test, and heteroscedasticity test, using SPSS 26.0 software.

The prerequisite tests that meet the testing criteria indicate that the data is suitable for proceeding with hypothesis testing, which is analyzed using multiple linear regression to show the relationship between the independent and dependent variables. The linear regression test and t-test in this study were assisted by SPSS IBM 26 for Windows, following the regression equation as shown below (Wijaya, 2019).

$$Y=\alpha+\beta_1 X_1+\beta_2 X_2+e \quad \text{..... (1)}$$

Notes:

Y : Dependent Variable

α : Constant

β : X variable coefficient

X : variable X

e : residual Value

b. Qualitative Method

The sampling for the qualitative research was determined using the purposive sampling technique, with two mathematics teachers as research subjects representing several *SMK Pusat Keunggulan* in Bali. Data collection for the qualitative method was conducted through semi-structured in-depth interviews to clarify the results of the quantitative method that could not be explained through the available data. The qualitative approach used descriptive analysis by presenting the results of the mathematics teachers' interviews and the responses from students that were considered unique and representative of the characteristics of the research subjects. Data validity was tested through prolonged engagement, enhancing perseverance during the study, triangulation, intensive discussions, member checks, and negative case analysis (Alwy et al., 2024).

c. Quantitative and Qualitative Integration Method

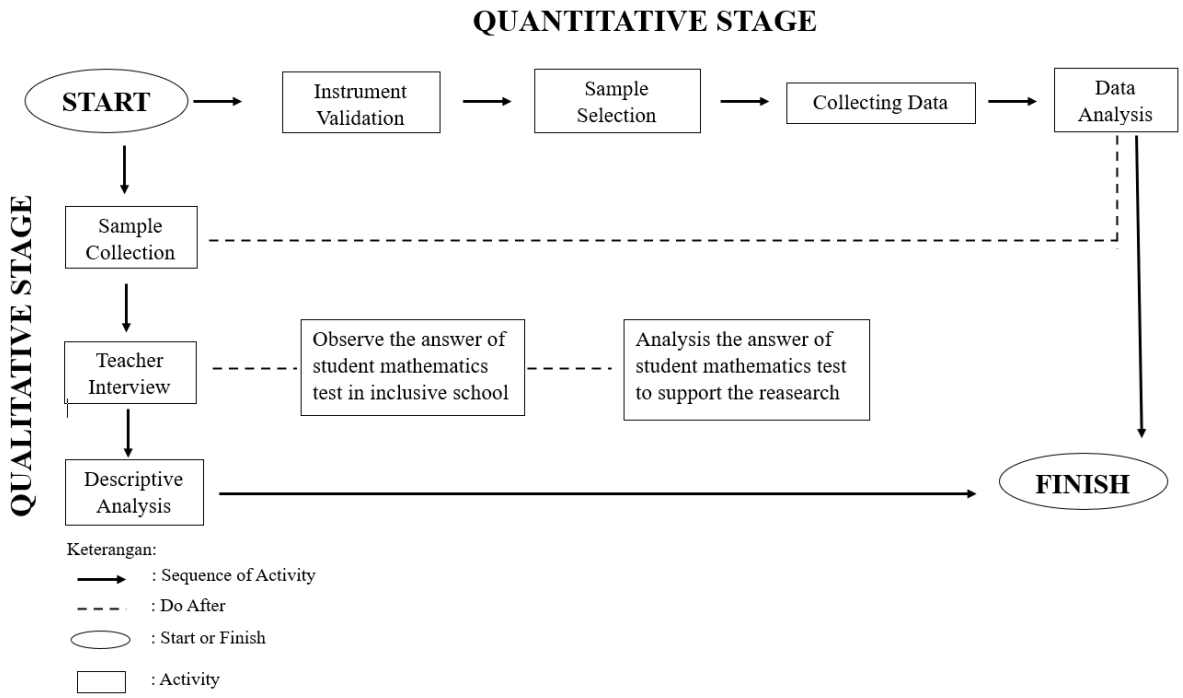


Image 1. Stages of Mixed Method

This study uses a mixed-methods approach by combining both quantitative and qualitative methods. The quantitative phase begins with instrument validation, sample selection, data collection, and data analysis. It is then followed by the qualitative phase, which involves teacher interviews and administering tests to representatives of regular students and students with special needs. The quantitative and qualitative results are then analyzed descriptively and complement each other to provide a deeper and more comprehensive understanding.

Results and Discussion

Quantitative results

The process of data collection using questionnaires as the main instrument was conducted from October 7 to 25, 2024. The collection of questionnaire data was complemented by semi-structured interviews to explore respondents' answers in-depth, resulting in a more detailed depiction of their experiences regarding the integration of the DfC approach into the concept of problem-based mathematics learning evaluation and teacher autonomy. The questionnaire data from 114 respondents is presented descriptively in Table 4 below.

Table 4. Descriptive Research Data

Variable	Minimum Score	Maximum Score	Mean	Standard Deviation
Understanding of DfC	53	76	63.99	1.664
Understanding of Problem-Based Mathematics Evaluation Concepts	55	79	65.08	3.614
Teacher Autonomy	57	88	81.58	2.674

Based on the analysis in Table 4, the respondent's understanding scores of the DfC approach ranged from 53 to 76, with an average score of 63.99. Teacher's level of understanding generally falls within the medium category, with only a few categorized as having a high understanding of DfC. This relatively even score distribution indicates that most teachers have a moderate grasp of the DfC concept, although there are slight variations among respondents in their mastery of the concept.

The teacher autonomy score based on Table 4 is 81.58, with a standard deviation of 2.674. These results indicate that the level of teacher autonomy in developing mathematics learning evaluations falls into the high category, based on the five-scale questionnaire conversion table. The relatively even score distribution suggests that most teachers at *SMK Pusat Keunggulan* in Bali have a relatively uniform level of autonomy within the high category, although there are slight differences in the teacher's levels of autonomy. This indicates that most teachers have a sufficient foundation for conducting independent learning evaluations at *SMK Pusat Keunggulan*, although some teachers still require improvement in certain aspects.

To test the relationship between understanding of DfC and teacher autonomy, a simple linear regression analysis was conducted using SPSS 26 for Windows. Based on the classic assumption tests that were performed, all regression assumptions were met. This allowed the hypothesis testing to proceed to the multiple linear regression stage. The multiple regression model for this study's hypothesis is presented in Table 5 below.

Table 5. Multiple Linear Regression Results

ANOVA[a]					
Design	*Sum of Squares*	Df	*Mean Square*	F	Sig.
Regression	6384.156	2	3192.078	132.637	.000[b]
Residual	2647.295	110	24.066		
Total	9031.451	112			

Based on the regression equation obtained in Table 5, the F-value is 132.637. The multiple regression analysis model fulfills the following equation: Y = 11.777 + 0.304X_1 + 0.627X_2..... (2)

According to Table 5, the calculated F-value of 132.637 is greater than the F-table value of 3.080, leading to the rejection of H_o. This indicates that both independent variables in the regression model simultaneously have a significant influence on teacher autonomy. This finding suggests that the higher the teachers' understanding of DfC and evaluation, the greater their autonomy.

Table 6. Partial Coefficient of Determination of X_1 and X_2 on Y

Design	R	R *Square*	*Adjusted* R *Square*	*Std. Error of the Estimate*
1	.841[a]	.707	.702	4.906

a. Predictors: (Constant), DfC

The R Square value in Table 6 indicates that the factors influencing teacher autonomy can be explained by the variables "understanding of DfC" and "problem-based mathematics learning evaluation concept" with a contribution percentage of 70%. Meanwhile, the remaining 30% is not explained by these independent variables but is instead influenced by other factors not included in the research model.

Qualitative Results

Integration of Design for Change in Inclusive Mathematics Learning Evaluations at *SMK Pusat Keunggulan*. The interviews with teachers reinforce the quantitative findings of this study, demonstrating that the DFC approach indirectly influences the enhancement of teacher autonomy at *SMK Pusat Keunggulan* in Bali. This approach is believed to drive innovation and transformation in the teaching process for both students and teachers in schools (Jia et al., 2023). The interview results revealed that mathematics teachers in *SMK Pusat Keunggulan* have understood and applied the DFC approach, both theoretically and sometimes unconsciously, as an innovative method to boost student participation and problem-solving skills. Here is a quotation from one of the mathematics teachers interviewed in this study: "*Naturally, as teachers, we might have been implementing these practices without fully realizing that each stage aligns with the syntax of the DFC approach. It turns out that we, as teachers, have already been conducting DFC evaluations because the stages in DFC are naturally implemented by teachers*". *Generally, I implement both concepts through project-based learning and assessment, allowing DFC to emerge*".

DFC-based evaluation provides students in inclusive schools the opportunity to apply mathematical concepts in real-world projects relevant to their areas of expertise. In *SMK Pusat Keunggulan* with departments such as mechanical engineering, accounting, and architecture, like SMK Negeri 3 Singaraja and SMK Negeri Bali Mandara, the implementation of learning combines the DFC approach with Project-Based Learning (Rahmawati et al., 2024; Sakiinatullaila et al., 2020).

The evaluation forms applied in this learning process include performance-based skills to produce products or portfolios Mathematics teachers teaching in the Accounting and Architecture departments revealed that during the DFC stage, they select content relevant to students' vocational fields before designing the evaluation format and rubrics. Here is a quotation from an interview with the related teachers: "*I strive to implement performance-based evaluations tailored to the students' fields, such as asking accounting students to conduct a financial report analysis for a cooperative. However, a common challenge is that not all material can be assessed this way, making relevant written tests still necessary*".

Teachers' understanding of the DFC approach is relatively high, based on the questionnaire results, although there are some teachers with a more limited understanding. One of the quotes from a teacher who has not fully grasped this approach is as follows: "*The teachers in this school are mostly senior, and we find it challenging to develop inclusive evaluations based on the DFC approach because we do not fully understand this concept yet. We are accustomed to the existing traditional assessment methods. Changing this perspective might require time and more intensive training*".

From this interview, it can be suggested that schools should provide ongoing training and sufficient support to teachers so that they can better understand and effectively implement the DfC approach.

Understanding the Concept of Problem-Based Mathematics Learning Evaluation at *SMK Pusat Keunggulan*. The understanding of teachers in *SMK Pusat Keunggulan* regarding the basic concepts of learning evaluation tends to be at a high level. Most teachers have already planned evaluations in accordance with applicable assessment standards, including designing types of evaluations suited to students' needs, creating questions, and conducting question analysis stages. Here is an excerpt from the interview with the teachers: "*Inclusive students have diverse learning styles, so evaluations need to be adjusted accordingly. My understanding of DfC, which is similar to differentiated learning, has been very helpful in creating evaluations that do not burden students. I often use portfolios or project-based assessments to observe their progress more concretely.*"

Teachers with strong planning and training in inclusive evaluation can provide meaningful feedback that supports student learning improvement. In *SMK Pusat Keunggulan*, teachers have implemented a range of alternative assessment methods beyond written tests, such as Q&A sessions, interviews, group discussions, presentations, portfolios, and project-based evaluations. These practices have made learning evaluations more inclusive, varied, and aligned with students' vocational competencies. This perspective is supported by the following interview excerpt: "*Previously, my evaluations focused only on multiple-choice or essay questions. However, after realizing there are 17 students with special needs in our school, I began implementing a more inclusive evaluation approach. For students with intellectual disabilities and difficulties in reading, I prefer oral assessments or asking them to explain concepts in their own way*".

The selection of these innovative evaluations aligns with the principles of assessment in the Merdeka Curriculum, which does not rely solely on written tests as the only indicator of learning success but prioritizes formative assessments. Teachers in *SMK Pusat Keunggulan* also innovate in implementing evaluations that accommodate the diversity of students' learning styles by utilizing Learning Management Systems (LMS). The use of LMS provides numerous benefits for both teachers and students in monitoring and completing evaluations, as reflected in the following quote: "*By using LMS, evaluations can be conducted objectively, as each student receives different questions. For students with intellectual disabilities, I present mathematics evaluations with visualizations in the form of images to simplify their understanding of the concepts in LMS*".

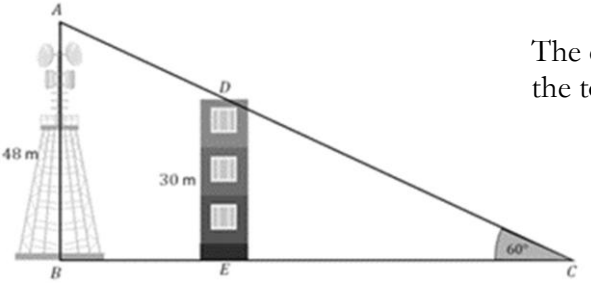
"*The use of e-learning in schools greatly facilitates learning evaluations. I can provide structured assignments, monitor student progress in real-time, and deliver feedback more quickly. E-learning also enables me to implement various types of evaluations that can be accessed at any time, thus supporting more inclusive assessments*".

To effectively assess mathematics in inclusive settings, question difficulty should be tailored to each student's learning barriers. While students with physical disabilities can manage questions similar to their peers, those with intellectual disabilities benefit from contextual, image-based problems linked to real-life situations. However, most teachers have not yet implemented this differentiation. An example of an inclusive math problem is provided below.

A tower and a building have heights of 48 m and 30 m respectively. When the sun's angle of elevation to the ground reaches 60°, the difference in the lengths of the shadows of the tower and the building is: …

Image 2. Mathematics-Based Problem Evaluation for Regular Student

A tower and a building have heights of 48 m and 30 m respectively. When the sun's angle of elevation to the ground reaches 60°, as shown in the following illustration!



The difference in the length of the shadow of the tower (BE) and the building is....

Image 3. Mathematics-Based Problem Evaluation for Inclusive Students.

Mathematical problems for both regular and special needs students are designed using a contextual approach that connects the material to their daily lives, simplifying the application of trigonometric ratio concepts. Teachers carefully consider the difficulty level and illustrations, and sometimes provide guidelines to help students find answers. The responses from both groups, based on questions with varying difficulty, are shown in Figure 4 below.

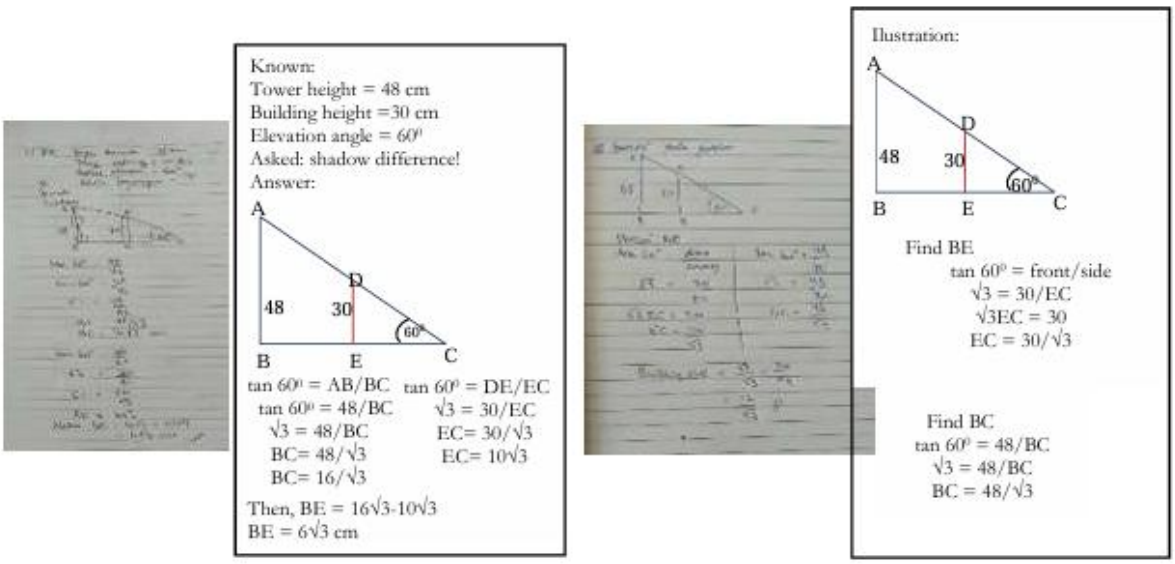


Image 4. Responses of Regular Students (Left) and Inclusive Students (Right)

The DfC approach in developing evaluations that can serve all students in inclusive schools, as illustrated above, encourages teachers to deepen their understanding of the DFC approach beyond their innovative capabilities.

Most teachers at *SMK Pusat Keunggulan* are considered innovative in designing evaluation formats; however, some still prefer to use exam questions from textbooks or previous years' exams. Here is a relevant excerpt from the interview.

"*Textbooks have been adjusted to match the curriculum and exam standards, making the questions within them highly relevant to the material students need to learn. Previous years' exam questions also provide an advantage as they help students understand the patterns of frequently occurring questions*".

"*I feel that the questions in textbooks already cover the material that has been taught well, and the questions from previous years are very helpful as they provide a clear overview of the exam format and the types of questions students will face*".

The results of these interviews reveal the reasons why some teachers prefer to use exam questions from textbooks or previous years' exams. They believe this approach provides good preparation for students and aligns with the applicable curriculum standards.

Autonomy of Mathematics *SMK Pusat Keunggulan* Teachers

Teachers in *SMK Pusat Keunggulan* in Bali have a more independent role compared to teachers in regular vocational schools. They not only teach but also engage in curriculum development, exam creation, and lesson planning tailored to industry needs. They utilize technology such as e-learning platforms and educational software to support the learning and evaluation process, as stated by

one teacher: "*Technology is incredibly helpful. I use various platforms to create questions that are not only multiple choice but also require students to analyze data, preparing them for the workforce.*"

Although independent, these teachers also prioritize collaboration in preparing teaching materials and exam questions, one of which is through MGMP meetings. In these meetings, they exchange ideas, share teaching techniques, and develop questions relevant to the workforce. As stated by one teacher in an inclusive school: "*At the MGMP Singaraja meeting, we discussed teaching modules and evaluation questions tailored to the workforce, including those designed for inclusive students*".

Collaboration between mathematics teachers and parents of students has also been carried out by teachers who handle students with high levels of special needs. Teachers communicate about the difficulties or specific needs faced by these students in classroom learning. Some teachers shared the following statements: "*I regularly meet with parents to discuss the progress of children with ADHD, including ways to modify exam questions according to their abilities*".

"*I send regular reports or progress notes on the inclusive children, ensuring that parents are always informed about their child's progress and challenges in the Hospitality class*".

Open communication with parents plays a crucial role in creating an inclusive learning environment, ensuring that every student has equal opportunities to grow and thrive.

Students with special needs in these schools generally fall into two categories: intellectual disabilities and physical disabilities. Those with intellectual disabilities face difficulties in abstract thinking, learning, and independent problem-solving, while those with physical disabilities experience mobility limitations due to temporary or permanent physical impairments often participating in learning with the help of assistive devices (Rahmawati et al., 2024).

Overall, mathematics teacher's ability to create inclusive learning evaluations is considered moderate. Questionnaire and interview results show that most teachers have not received specific training on inclusive evaluation. Some teachers adapt existing methods independently, though without a solid theoretical foundation. Interestingly, even without explicit knowledge of the DfC concept, many teachers unknowingly apply its principles in their teaching (Bosch et al., 2025; Man et al., 2022; Taratukhin & Pulyavina, 2018).

The integration of the DfC approach in learning and evaluation has been implemented in line with the FIDS stages, beginning with the *Feel* phase, which emphasizes empathy-crucial in inclusive education. In this phase, students are encouraged to understand problems while appreciating differences in their peers' needs, abilities, and perspectives. This empathy-driven approach helps teachers better understand individual student needs, allowing for fair and inclusive evaluations that encourage active participation. Teachers apply process-focused assessments, enabling students with special needs to solve problems using suitable strategies, such as calculation tools or simple modeling techniques (Blundell, 2022, 2024; Citrawan et al., 2024).

Some teachers have taken the initiative to involve the parents of students with special needs in discussions to identify the challenges faced by these students whether academic, social, or emotional that might not be fully observed by the teacher in the classroom. Parental involvement is crucial in designing evaluations for students with special needs to ensure a more flexible assessment approach, such as simplifying learning materials, modifying question formats, and implementing personalized teaching strategies (Sakiinatullaila et al., 2020). This approach contrasts with regular students, who typically receive learning materials directly in accordance with standard curriculum.

In the Imagine and Do phases of implementing the DFC approach, teachers begin guiding students to think creatively in finding solutions to problems identified during the Feel phase. These stages play a crucial role in developing students' imagination and problem-solving skills, especially when addressing challenges in the learning evaluation process (Lord, 2019). For students with special needs, the role of the teacher as a facilitator becomes particularly significant to ensure their maximum participation. Teachers need to encourage students to express their ideas in ways that suit their individual abilities, such as using visual aids or tailoring instructions to their needs (Waiyakoon et al., 2015; Yip et al., 2025).

In the Do phase, students engage in mathematics evaluations through projects, assignments, or tests, with a focus on the learning process rather than just outcomes. Teachers implement project-based assessments and adapt tasks for students with special needs, using tools like calculation aids or simple models. An interview at SMK Negeri 3 Singaraja revealed that students with intellectual disabilities often struggle with abstract concepts, requiring simplified instructions, concrete examples, and step-by-step guidance to support their understanding.

In the Share phase, vocational high school students present the outcomes or solutions they developed to address identified problems and explain how these solutions resolve the issues. For students with special needs, this phase is crucial as it not only enables them to showcase their work but also boosts their motivation, enhances engagement, and promotes information exchange with regular students. Additionally, it provides an opportunity for all students to articulate their understanding of mathematical concepts. A common practice at *SMK Pusat Keunggulan* is holding reflection sessions after exams or at the end of the learning process, where both regular and special needs students share difficulties faced during tasks and discuss alternative problem-solving techniques (Sudiarta, 2024).

Overall, some teachers in inclusive vocational schools designated as *SMK Pusat Keunggulan* have begun integrating the DfC approach into learning evaluations, although their average understanding remains in the medium category. This is understandable, as not all mathematics teachers in inclusive schools are responsible for teaching students with special needs. Some teachers have expressed familiarity with the theory of DfC, but they have not been able to fully integrate the approach directly in the classroom, considering the number of students with special needs varies across schools.

The DfC approach introduces a new paradigm in developing learning evaluations, emphasizing an understanding of students' needs, creativity, and the cultivation of life skills (Blundell, 2024).In inclusive schools, particularly in *SMK Pusat Keunggulan*, the application of DfC in designing mathematics evaluations has shown a positive impact on teacher autonomy during the planning and implementation stages of these evaluations. This autonomy is reflected in teachers' ability to design evaluations autonomously, without relying solely on existing evaluation standards (Widana et al., 2023).

The selection of evaluation methods is guided by students' learning styles and the mathematics content being taught, following the FIDS stages of the DfC framework. Teachers with a solid grasp of DfC principles tend to implement diverse evaluation methods aligned with students' learning preferences. Schools such as SMK Negeri 1 Masubud, SMK Negeri Bali Mandara, and SMK Negeri 1 Kubu frequently utilize LMS to support structured, accessible, and responsive mathematics evaluations. LMS platforms enable teachers to conduct varied assessments including text and audiovisual formats while providing real-time feedback and accommodating the diverse learning needs of students in inclusive settings (Putra et al., 2021; Sumandya et al., 2023).

The quantitative data findings obtained a calculated F value of 132.637, which means that understanding the DFC approach and problem-based mathematics evaluation has a significant effect on teacher autonomy. The results of this quantitative study are in line with the findings of qualitative data by interviewing teachers at *SMK Pusat Keunggulan* in Bali, which showed that most teachers at vocational schools have consciously or unconsciously implemented the DfC approach in project-based learning and evaluation, although there are still teachers who have difficulty due to limited understanding, especially in compiling inclusive evaluations. The results of interviews regarding problem-based mathematics learning evaluations show that teachers at *SMK Pusat Keunggulan* generally have a high understanding of learning evaluation and have implemented various inclusive and innovative evaluation methods, including the use of LMS and project-based assessments. However, some teachers still rely on questions from textbooks or previous year's exams because they are considered more practical and in accordance with the curriculum. Teachers at *SMK Pusat Keunggulan* have a more independent and innovative role, both in curriculum development, evaluation, and utilization of technology. They also actively collaborate through MGMP and communicate with parents of inclusive students to support adaptive and inclusive learning. Therefore, this research is in line with the integration of methods carried out to confirm the known quantitative results.

The findings align (Jia et al., 2023) who noted that the DfC approach allows teachers to integrate Design Thinking into curricula and adopt innovative evaluation methods, thereby enhancing student engagement and learning relevance. Similarly, (Sumandya et al., 2023) found that design-based approaches (Understanding by Design) boost teachers' autonomy and creativity in developing diverse evaluation models in inclusive schools. Consequently, mathematics evaluations in inclusive vocational schools should be project-based, incorporate self-assessment, differentiate among learners (Queiroz-Neto et al., 2021; Taratukhin & Pulyavina, 2018). Without teacher autonomy, implementing such evaluation designs would be challenging.

Conclusion

The result of this study indicate that mathematics teachers' understanding of the DfC approach in inclusive vocational schools designated as *SMK Pusat Keunggulan* significantly influences their autonomy in designing mathematics learning evaluations. Implementing DfC-based evaluations fosters innovation and allows students with special needs to engage more actively in the learning process. This understanding empowers teachers to adapt assessments to diverse student needs and learning styles. Moving forward, the integration of DfC is expected to expand to elementary and secondary education, aiming to strengthen teachers' capacity to create inclusive and meaningful mathematics evaluations.

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