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Technology Integration in Community Service: Empowering IDX Employees with Data Visualization Skills

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ABSTRACT

Background: The rapid growth of digitalization in the capital market requires the Indonesia Stock Exchange (IDX) to deliver transparent, accurate, and understandable information through data visualization. However, employees at the IDX West Kalimantan Representative Office rarely process and visualize data, even though it is essential for carrying out daily tasks.
Contribution: This study fills the gap in technology-based community service programs that rarely integrate infographic training with information literacy enhancement in capital market education. The novelty of this study lies in the evaluation of the community service program, which not only measures the effectiveness of the training but also employs CB-SEM to identify the factors influencing participants' learning outcomes.
Method: The Statistics Study Program, Untan, conducted a training workshop combining theory and practice with real data. A situational analysis with IDX representatives was first carried out to identify needs and design the program. Effectiveness was evaluated using pre-tests, post-tests, and satisfaction surveys.
Results: The paired t-test results at the 5% significance level demonstrating the effectiveness of infographic training in enhancing data visualization skills. In addition, CB-SEM analysis revealed that the module variable was the dominant factor, highlighting the importance of structured and relevant training materials in supporting participants' learning outcomes.
Conclusion: The training effectively enhanced the knowledge and skills of IDX West Kalimantan Representative employees in data processing and visualization.

1. Introduction

In the era of digitalization and information transformation, the rapid growth of capital market activities in Indonesia demands data presentation that is not only comprehensive but also easily understood, whether by traders, investors, or the general public who wish to expand their knowledge about the capital market [1]–[4]. As an institution mandated to provide information and education related to the capital market for the public [5], the Indonesia Stock Exchange (IDX) faces a major challenge in transforming such extensive and dynamic data into information that is easily comprehensible [1].

Presenting data in the form of tables or textual reports is often not effective for directly identifying trends, patterns, or anomalies occurring in the market. Through the use of data visualization, stock price movements, investor behavior, and market fluctuations can be identified and interpreted more easily [1]. According to Ware [6] and Cairo [7], data visualization is an approach that transforms numerical data into graphical representations that enhance understanding and the visual appeal of information. Bateman [8] further emphasize that the use of simple yet informative visual elements in infographics can improve audience recall and comprehension of the main message being conveyed. Thus, charts, interactive dashboards, and infographics serve as highly effective tools for promoting investment literacy and public understanding of capital market dynamics [9]. Furthermore, improving the quality of visual data presentation has a direct impact on public trust and the transparency of Indonesia's capital market [10]. Therefore, the implementation of data visualization supports two strategic functions of the IDX simultaneously.

To achieve these strategic functions, strengthening the human resource capacity within the IDX is crucial, particularly in developing data visualization skills. This capacity-building effort is not only important for the IDX head office but also for regional representative offices such as the IDX West Kalimantan Representative Office, which acts as an extension of the central IDX in carrying out educational and information dissemination activities. This consideration became the basis for the Statistics Study Program, Faculty of Mathematics and Natural Sciences, Tanjungpura University (FMIPA UNTAN), to conduct a community service program in collaboration with the IDX West Kalimantan Representative Office.

The Statistics Study Program of FMIPA UNTAN has an academic responsibility to carry out the Tri Dharma of Higher Education, which includes education, research, and community service. One form of this implementation is through collaboration with the IDX West Kalimantan Representative Office. This activity was designed based on the urgency of digitalization and the results of a field orientation related to the partner's needs analysis. Noe [11] stated that the first stage in designing a training program is conducting a needs analysis to ensure that the training content is relevant and targeted. Based on the needs identification results, it was found that most employees, administrators, and securities representatives at the IDX West Kalimantan office lacked adequate skills in producing professional data visualizations and infographics. This finding highlights a gap between the need for communicative data presentation and the competency of IDX employees in visualizing data.

Moreover, there is no research that explicitly examines data visualization training for regional or provincial IDX representative offices as the subject of study. Yet, these regional offices serve as the front line for education, promotion, and capital market development in their respective areas. Previous studies have mainly focused on data visualization in central financial institutions, government agencies, schools, or universities. Furthermore, most previous studies have addressed financial literacy training and data visualization or infographic separately, without specifically integrating the two within the context of capital market information literacy through an infographic approach. This is as seen in the work of Dwidjosumarno [12] and Porter [13], whose community service programs focused solely on providing basic knowledge of the capital market as well as knowledge about investments and capital market investment products. Then, Agwil [14] conducted a community service program that focused solely on data visualization.

To address this issue, the Statistics Study Program collaborated with the IDX West Kalimantan Representative Office to design a community service program titled "Data Visualization Training for Employees of the Indonesia Stock Exchange West Kalimantan Representative Office." Participants in this program included all employees, the head of the office, trainers, administrators, and representatives from securities companies under the supervision of IDX West Kalimantan.

The contribution of this research is to provide a training aimed at improving participants' competencies in processing, analyzing, and presenting capital market data through visualizations such as infographics, thereby supporting transparency and public education in the capital market sector. The applications used in this training include Microsoft Excel and Canva. Excel is utilized for data analysis, while Canva is used to design infographics. The advantages of using these tools lie in their simplicity and user-friendly interfaces, which do not require programming skills [15], [16]. Both applications have straightforward interfaces and are easy to operate. Canva has been widely adopted as a primary tool for creating visual designs due to its extensive features and ease of use. Users can simply log in to access various menus and free templates. This flexibility allows users to create visually appealing and informative designs [14]. Meanwhile, Microsoft Excel, which is typically pre-installed on most personal computers (PCs), can be readily used without additional installation [17]–[19]. It is a popular spreadsheet application equipped with a wide range of functions, enabling users to efficiently perform calculations, data processing, and create charts or graphs for visualization purposes [20].

The training is designed to combine theoretical explanations with practical sessions led by instructors, supported by teaching assistants using actual data from the IDX West Kalimantan Representative Office. Through this activity, participants are expected to develop data visualization skills that can be applied in reporting, information publication, and capital market literacy initiatives in the region. Additionally, this activity serves as a means for the Statistics Study Program to strengthen its collaboration with the IDX West Kalimantan Representative Office.

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This Community Service Research (PKM) project focuses not only on the implementation of activities but also emphasizes the evaluation aspect. The evaluation was conducted to determine whether the training provided was truly effective in enhancing participants' competencies in analyzing and visually presenting capital market information. Additionally, factors influencing participants' learning outcomes are analyzed. This is done because previous studies generally only measured the effectiveness of the training. For instance, the study by Fadmi and Buton [21] and also Martha [22] merely tested whether the training was effective or not. No further analysis was conducted to identify the factors influencing participants' learning outcomes. Therefore, this study aims to address this gap by incorporating a CB-SEM analysis to identify the dominant factors influencing participants' learning outcomes.

2. Method

2.1. Implementation of The Community Service Program

Based on the previously described introduction, the implementation of this Community Service Program (PKM) directly responds to the needs identified from the target group, namely the employees of the Indonesia Stock Exchange (IDX) West Kalimantan Representative Office. The training was designed not only to address the limitations in data visualization practices but also to strengthen participants' capacity in creating informative infographics that can be shared with the public. To achieve these objectives, the PKM methodology was systematically organized into several stages as follow:

a. Field Orientation

   This stage involved site visits, preliminary observations, and a needs analysis of the partner institution through direct coordination with the relevant parties at the IDX West Kalimantan Representative Office.

b. Training Preparation

   Based on the results of the partner needs analysis, several preparatory steps were carried out, including determining task distribution among lecturers and students, selecting the applications to be used in the training (Microsoft Excel and Canva), designing the training module, preparing tools and supporting facilities, and arranging the training schedule and rundown. The determination of training materials was based on the participants' needs analysis to ensure that the developed program was relevant to real conditions in the field [11].

c. Training Implementation

   The training combined theoretical presentations and hands-on practice using real data provided by IDX Kalimantan Barat. During this stage, pre-test and post-test assessments were conducted to measure participants' improvement, alongside the distribution of satisfaction questionnaires to evaluate perceptions of the training and identify variables or factors influencing training effectiveness.

d. Training Evaluation

Evaluation was conducted to assess the effectiveness of the activity through analysis of pre-test and post-test data and participants' feedback on the program implementation. The pre-test and post-test design was applied to measure improvements in participants' knowledge and skills before and after the training. Additionally, monitoring and evaluation were carried out using Likert-scale questionnaires to capture participants' perceptions of various aspects of the program (training schedule and duration, trainer competence, module quality, applications used, and supporting facilities) as well as their feedback.

To clarify the workflow of the activities, the methodology of this Community Service Program (PKM) is illustrated in the form of a Fishbone Diagram, as shown in Figure 1.

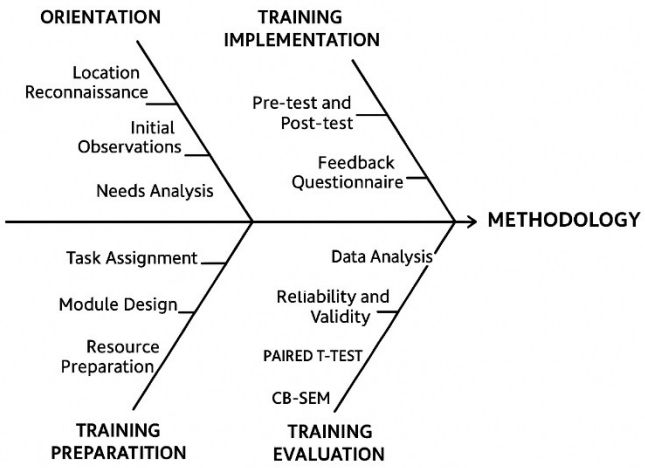

Figure 1. Fishbone diagram of the PKM methodology for data visualization training at the Indonesia stock exchange (IDX) West Kalimantan representative office

2.2. Research Design

This study employs a quantitative research design to evaluate the community service program that was implemented. The evaluation process consisted of several analytical steps to get the conclusions. These included data collection, reliability and validity testing of the questionnaire, normality testing to determine whether a parametric test (paired t-test) or non-parametric test would be applied, and finally, effectiveness analysis of the training program using pre-test and post-test data. If the training was found to be effective, a further analysis using Covariance-Based Structural Equation Modelling (CB-SEM) was conducted to identify factors influencing training effectiveness.

The program involved 27 employees of the IDX West Kalimantan Representative Office. Participants were selected using the purposive sampling method, considering the availability of employees who were not engaged in urgent work duties. Subsequently, data from all participants was collected through pre-tests, post-tests, and a satisfaction survey. The satisfaction survey included several questions related to the duration of the training, the trainer

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and the training team, the training modules, the applications used during the training, consumptions and supporting facilities, as well as the overall implementation of the training. Each question was measured using a 1–5 Likert scale. Additionally, the survey included open-ended questions aimed at gathering suggestions and feedback from participants regarding the training implementation. The collected data was then analysed using several analytical methods. More specifically, the analysis steps conducted in this study are described as follows:

a. Reliability and Validity Testing

Before conducting data analysis, the questionnaire instrument was tested for reliability and validity. Reliability was tested using Cronbach's Alpha, which measures the internal consistency among items within a construct. The formula in Eq. (1) [23]:

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum_{i=1}^{k}\sigma_i^2}{\sigma_T^2}\right) \quad (1)$$

where k is the number of items, σ_i^2 is the variance of each item, and σ_T^2 is the total variance (sum of all items). A value of α greater than 0.70 is considered acceptable or reliable [23]. Meanwhile, validity was tested using the Corrected Item-Total Correlation for each indicator [24], calculated in Eq. (2):

$$r_{it} = \frac{\sum(X_i - \bar{X}_i)(T - \bar{T})}{\sqrt{\sum(X_i - \bar{X}_i)^2 \sum(T - \bar{T})^2}} \quad (2)$$

where X_i represents the score of items i, and T represents the total construct score excluding that item. According to Hair [24], an item is considered valid if the corrected item-total correlation is greater than 0.30. Items with lower correlation values should be revised or removed to improve construct validity.

b. Training Effectiveness Test

To test the effectiveness of the training (i.e., whether there is a significant difference between the mean pre-test and post-test scores), a paired t-test was used. This test is part of the parametric analysis; therefore, the assumption of normal data distribution must be met beforehand. Given that the sample size consisted of 27 participants, the appropriate normality test was the Shapiro–Wilk test [25]. The Shapiro–Wilk statistic is calculated Eq. (3) [25]:

$$W = \frac{\left(\sum_{i=1}^{n} a_i \cdot x_{(i)}\right)^2}{\sum_{i=1}^{n}(x_i - \bar{x})^2} \quad (3)$$

where x_i represents ordered sample values, a_i are constants derived from the covariance matrix of the order statistics, and $\bar{x}$ is the sample mean. A non-significant p-value ($p > 0.05$) indicates that the data follow a normal distribution. If the data were normally distributed, a paired t-test was then applied using formula in Eq. (4) [26]:

$$t = \frac{\bar{d}}{s_d/\sqrt{n}} \quad (4)$$

where $\bar{d}$ is the mean difference, s_d is the standard deviation of the differences, and n is the number of paired observations. A value of $t > t_{tabel}$ indicates that the post-test mean is higher than the pre-test means, meaning the training was effective.

c. Advanced Analysis Using CB-SEM

If the paired t-test indicated a significant improvement, further analysis was conducted using Covariance-Based Structural Equation Modeling (CB-SEM) to identify the factors influencing training effectiveness [24]. According to Hair [24] in *Multivariate Data Analysis*, CB-SEM is a confirmatory technique used to examine causal relationships between latent constructs and observed variables through the analysis of covariance structures. The CB-SEM analysis consists of two main stages. First, measurement Model (Outer Model), This stage aims to test the validity and reliability of latent constructs through analysis of factor loadings, Average Variance Extracted (AVE), and Composite Reliability (CR). A factor loading ≥ 0.70 indicates that an indicator is representative of its construct. AVE ≥ 0.50 indicates convergent validity is achieved. CR ≥ 0.70 indicates good construct reliability. Second, structural Model (Inner Model), This stage tests the relationships between latent constructs and assesses the strength of influence among variables.

It includes analysis of path coefficients, R^2 values (coefficient of determination), and Goodness of Fit Index (GFI). A p-value < 0.05 indicates a statistically significant relationship between constructs. This approach was also applied by Sodikin [27] in their study titled *"Penerapan Covariance-Based Structural Equation Modeling (CB-SEM) pada Kepuasan Masyarakat terhadap Pelayanan Kepolisian"*. The study confirmed that CB-SEM is effective for identifying complex latent relationships and evaluating the dominant factors affecting satisfaction or program effectiveness. Therefore, applying CB-SEM in this PKM project is expected to reveal the influence of factors on the effectiveness and success of the training program.

3. Results and Discussion

3.1. Field Orientation

The preparation stage of the Community Service Program (PKM) began with a field orientation. The field orientation aimed to conduct a site survey, make preliminary observations related to the institutional needs analysis, and directly coordinate with relevant stakeholders. The coordination results determined that the PKM would be held on Thursday, July 31, 2025, at the Training Room of the IDX West Kalimantan Representative Office. The determination of the training materials was based on the results of the institutional needs analysis. This analysis used an online questionnaire designed to map participants' knowledge. Based on the survey results, the majority of participants (59%) were interns at the IDX West Kalimantan Representative Office, while 6% were IDX employees, and 12% were staff from securities companies under the supervision of IDX West Kalimantan in Figure 2.

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Figure 2. Discussion with the Indonesia stock exchange, West Kalimantan representative office

Most participants expected the training materials to focus on data visualization using Microsoft Excel, followed by infographic design using Canva. Furthermore, all participants preferred a comprehensive learning approach, including training module, theoretical presentations by the trainer, discussion sessions, and hands-on practice. Participants also hoped that the acquired skills would enhance their ability to visualize data and support their independence in producing infographics. Moreover, 76.5% of participants expressed the expectation that these skills could be applied in their work or educational activities.

The survey also showed that 52% of participants frequently used Canva, and 38% often used Excel. However, the level of proficiency was relatively low—only 35% were proficient in Canva and 21% in Excel. In infographic design, only 21% often created infographics, and just 6% were considered proficient. Referring to the needs analysis and the discussion with Mr. Taufan Febiola, Head of the IDX West Kalimantan Representative Office, it was decided that the PKM training material would focus on developing data visualization and infographic creation skills using Microsoft Excel and Canva.

3.2. Preparation

The preparation phase of the Community Service Program (PKM) began with internal coordination among team members. There were three meetings with each meeting focused on different aspects, including several components to support the PKM, task distribution, and ensuring technical readiness for implementation. In addition, the room arrangement was conducted to ensure the availability of necessary facilities and supporting equipment so that the training activities could run optimally.

3.3. Implementation of the PKM Program

The implementation of the PKM was held on Thursday, July 31, 2025, in the Training Room of the Indonesia Stock Exchange (IDX) West Kalimantan Representative Office. The event was attended by participants consisting of IDX staff, interns, and representatives from several securities companies in West Kalimantan. The training activity was conducted offline with direct facilitation by the PKM team in Figure 3.

Figure 3. Opening session of the PKM sctivity

Before the training began, the event started with an opening session that included welcome speech from the Head of the IDX West Kalimantan Representative Office and the Coordinator of the Statistics Study Program, Tanjungpura University, followed by a prayer. Afterwards the participants were given a pre-test to identify their initial level of understanding and skills related to the training material. The main training session lasted approximately three hours, focusing on data visualization and infographic creation using Canva and Microsoft Excel.

Figure 4. Training material presentation by Mr. Ray Tamtama, M.Si.

After the training session, participants took a post-test to evaluate the improvement in their understanding and skills after completing the session in Figure 4. The post-test served as an evaluation instrument to measure the effectiveness of the program, where the results were compared with the pre-test scores to assess the extent of improvement (Fraenkel, Wallen, & Hyun, 2015). Thus, the comparison between pre-test and post-test scores became an indicator of the success of the PKM activity.

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3.4. Monitoring and Evaluation

The evaluation of the Community Service Program (PKM) activities was carried out after the training session by distributing a satisfaction questionnaire to all participants who attended the data visualization training. The questionnaire instrument was developed to measure participants' satisfaction across several key aspects of the training, including the quality and relevance of the materials, the training approach, the adequacy of logistical support such as food and beverages, and the perceived overall benefits of the program. The results of this evaluation were intended not only to assess the success of the training but also to provide valuable insights and constructive feedback for improving the design and quality of future PKM activities.

In general, the activity received very positive assessments based on feedback from 27 participants who completed the evaluation questionnaire. The following are the summarized results of participants' evaluations of the training, categorized by the assessed dimensions.

a. Training Duration

   Based on the evaluation results, the majority of participants agreed or strongly agreed with the statements related to the duration and schedule of the training. A total of 82% of participants agreed that the training duration was appropriate, and 81% stated that the training was conducted according to the scheduled time.

   However, around 18% of participants responded neutrally regarding duration, indicating that might have preferred a longer session. This assumption is reasonable since the infographic design training typically requires more than three hours to produce optimal results. Nevertheless, the three-hour training session was still perceived as beneficial, as participants could understand the basic concepts and main steps of creating effective infographics while gaining hands-on experience. Overall, the training was carried out according to plan and within the scheduled timeframe, with good time management and adequate breaks.

b. Trainer and Training Team

   The trainer aspect received positive evaluations. Most participants (more than 78%) agreed or strongly agreed that the trainer delivered the material clearly, engagingly, and in a non-monotonous manner. In addition, 80% of participants stated that the trainer was able to answer questions well and provided relevant examples. The training team was also rated positively for supporting the learning process and assisting effectively throughout the session.

c. Module

   From the tabulated results, 81% of participants stated that the materials and modules provided were helpful for understanding the training content, and 76% agreed that the language used was clear and easy to understand. Participants also felt that the materials were practical, applicable, and systematically organized. A small proportion of participants (19%) responded neutrally, suggesting that the module content could be further refined to better accommodate different levels of participant understanding.

d. Applications and Features Used (Microsoft Excel and Canva)
The use of learning applications was considered highly relevant and effective. A total of 78% of participants agreed that the chosen applications were appropriate for the purpose of data visualization, and 81% believed that Microsoft Excel and Canva matched their needs and skill levels. Most participants (over 80%) also agreed that the applications were easy to access and helpful in their daily work. However, around 11–15% of participants remained neutral regarding application use and licensing costs. This suggests that future training sessions might include information about alternative free applications or additional supporting resources.

e. Consumption and Supporting Facilities
The quality of food and beverages also received favorable ratings. Most participants (77%) agreed or strongly agreed that the meals and drinks provided were of good quality and hygienically served. About 23% of participants responded neutrally, possibly due to menu preferences. Nevertheless, the overall feedback on the consumption aspect was positive and contributed to participants' comfort throughout the training.

f. Overall Training Evaluation
This dimension showed highly positive results and served as a key indicator of the training's success. Between 81% and 89% of participants agreed or strongly agreed with all aspects of the training, including the atmosphere, material relevance, usefulness for career development, and their willingness to recommend it to colleagues. Participants expressed that they had gained new knowledge and skills and found the training enjoyable and interactive. They also hoped that similar training could continue regularly with a wider variety of topics. This indicates that the planning and implementation of the training were effective and met the intended objectives. One area to note was that around 15–20% of participants responded neutrally to the statement about "confidence in applying data visualization," suggesting a need for longer practice sessions or additional mentoring to strengthen participants' readiness in applying what they learned. However, some feedback was also provided for future improvement, including emphasizing the need to slow down the delivery pace, enhance coordination between trainers and assistants, simplify technical explanations for non-mathematical participants, and broaden the scope of Canva and Excel materials.

Based on the descriptive analysis, the training successfully achieved its learning objectives and enhanced participants' competencies. All evaluation dimensions, including planning, delivery, materials, application, and supporting aspects, showed high satisfaction levels (above 75%). In addition to descriptive analysis in assessing the effectiveness of the Community Service Program (PKM), a comparative analysis of participants' pre-test and post-test results was also conducted. The analytical method used was the paired sample t-test. Prior to the test, a normality test was performed on the difference data using the Shapiro–Wilk test.

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The hypotheses for the Shapiro–Wilk normality test were as follows:

- H_0: The difference data (post-test – pre-test) are normally distributed.
- H_1: The difference data are not normally distributed.

With a significance level of $\alpha = 0.05$, the decision criteria were:

- If *p-value* > 0.05 → fail to reject H_0 → the data are normally distributed.
- If *p-value* ≤ 0.05 → reject H_0 → the data are not normally distributed.

Table 1. Shapiro–Wilk normality test results

Variable	W Statistic	P-value	Decision
Difference (Post-test – Pre-test)	0.962	0.327	Fail to reject H_0

Based on Table 1, the obtained *p-value* > 0.05 indicates that the difference between pre-test and post-test scores follows a normal distribution. Therefore, the normality assumption was met, allowing the analysis to proceed with a paired sample t-test.

The one-tailed paired sample t-test hypotheses were:

- H_0: Mean post-test ≤ mean pre-test ($\mu_2 \leq \mu_1$).
- H_1: Mean post-test > mean pre-test ($\mu_2 > \mu_1$).

With a significance level of $\alpha = 0.05$, the decision rules were as follows:

- If $t_{value} < t_{table}$ → fail to reject H_0 → mean post-test ≤ mean pre-test.
- If $t_{value} > t_{table}$ → reject H_0 → mean post-test > mean pre-test.

Table 2. Paired sample t-test (One-tailed test) results

Variable	t_{value}	t_{table}	Decision
Post-test vs Pre-test	3.8154 (df=26)	2.056	Reject H_0

The results in Table 2 show that $t_{value} > t_{table}$, indicating that the mean post-test score was significantly higher than the pre-test score. This finding demonstrates that the training program effectively improved participants' abilities. To further explore the factors influencing participants' performance improvement, an analysis was conducted on five evaluation dimensions representing latent variables (constructs), namely: Training Duration and Schedule, Trainer and Training Team, Materials and Module, Applications Used, and Consumption.

Because the response variable (learning outcome/post-test) is numerical, while the independent variables consist of several indicators measured using a Likert scale (1–5) representing latent variables, the appropriate analytical method to identify the factors influencing participants' improvement across these five evaluation dimensions is Covariance-Based Structural Equation Modelling (CB-SEM).

Table 3. Output of indicator validity and reliability tests

Variable Names	Indicator	Corrected Item-Total Correlation	Cronbach's Alpha
Training Duration and Schedule	DJ1	0.790	0.908
	DJ2	0.744	
	DJ3	0.764	
	DJ4	0.757	
	DJ5	0.785	
	DJ6	0.795	
	DJ7	0.525	
Trainer and Training Team	NT1	0.873	0.954
	NT2	0.792	
	NT3	0.904	
	NT4	0.802	
	NT5	0.796	
	NT6	0.842	
	NT7	0.824	
	NT8	0.748	
	NT9	0.761	
Materials and Module	M1	0.694	0.942
	M2	0.821	
	M3	0.791	
	M4	0.830	
	M5	0.797	
	M6	0.805	
	M7	0.836	
	M8	0.788	
Applications Used	A1	0.747	0.95
	A2	0.821	
	A3	0.866	
	A4	0.798	
	A5	0.778	
	A6	0.757	
	A7	0.806	
	A8	0.794	
	A9	0.845	
Consumption	K1	0.865	0.969
	K2	0.951	
	K3	0.938	
	K4	0.861	
	K5	0.947	

The first step in evaluating the measurement model was to ensure that the indicators used exhibited good internal consistency. Reliability testing was conducted by examining Cronbach's Alpha and the Corrected Item–Total Correlation values for each indicator. Based on the processed data summarized in Table 3, all constructs showed Cronbach's Alpha values above 0.70. According to Hair [24], a Cronbach's Alpha value of ≥ 0.70 indicates acceptable reliability. Thus, the instrument used in this study can be considered reliable, as it consistently

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measures the intended constructs. In addition, the Corrected Item–Total Correlation values in Table 3 for all indicators were above 0.5. According to Ghozali [28], an item–total correlation value of ≥ 0.50 indicates that the item is not only valid but also provides a strong contribution to representing the construct. Therefore, these indicators consistently and accurately explain the latent variables. No indicators needed to be eliminated, as all met the minimum criteria for item–total correlation and reliability. Consequently, the instrument used in this study was proven to be reliable and valid, allowing the analysis to proceed to the next stage, construct validity testing using CBSEM.

Table 4. Indicator validity (Outer loading) and multicollinearity (VIF) test results

Indicator	Application Used	Training Duration and Schedule	Consumption	Materials and Module	Trainer and Training Team	VIF
A1	0.874					2.768
A2	0.859					4.328
A3	0.870					5.416
A4	0.854					6.818
A5	0.815					4.843
A8	0.818					3.886
A9	0.841					4.759
DJ1		0.703				3.638
DJ2		0.853				2.473
DJ3		0.893				2.364
DJ4		0.838				2.617
DJ5		0.728				4.175
DJ6		0.825				2.643
K1			0.941			4.602
K2			0.968			6.747
K4			0.893			3.070
M1				0.775		2.369
M2				0.867		5.178
M3				0.835		4.968
M4				0.874		6.589
M5				0.849		4.354
M6				0.851		4.552
M7				0.876		8.278
M8				0.843		4.364
NT1					0.954	5.810
NT2					0.891	5.270
NT3					0.899	7.320
NT4					0.903	4.720
NT6					0.895	5.220
NT8					0.741	3.390

Subsequently, an evaluation of the measurement model was conducted to ensure that the indicators used accurately represented the latent constructs being measured. The

measurement model evaluation included indicator validity testing and multicollinearity testing among indicators. Indicator validity was assessed using the factor loading (outer loading) values. According to Hair [24], an indicator is considered valid if its loading value is ≥ 0.70. In this study, most indicators had loading values above 0.70, indicating that they strongly contributed to reflecting the latent constructs, though a few indicators scored slightly below that threshold. Additionally, Variance Inflation Factor (VIF) values were examined to identify potential multicollinearity among indicators. Traditionally, VIF values below 10 are considered acceptable, indicating that multicollinearity is not a serious issue [24].

Indicators that did not meet the outer loading criterion or had VIF values greater than 10 were excluded from the model. Based on Table 4, all factor loading values exceed 0.70, and all VIF values are below 10. Therefore, the measurement model satisfies both the indicator validity and multicollinearity requirements, allowing further evaluation of construct reliability and convergent validity. Cronbach's Alpha, rho_A, and Composite Reliability (CR) were used to test reliability, while the Average Variance Extracted (AVE) was used to assess convergent validity. The results are summarized in Table 5.

Table 5. Indicator validity (Outer loading) and multicollinearity (VIF) test results

Variable	Cronbach's Alpha	rho_A	Composite Reliability	AVE	Interpretation
A (Application Used)	0.938	0.971	0.947	0.719	Reliable & valid
DJ (Training Duration & Schedule)	0.924	0.751	0.919	0.655	Reliable & valid
K (Consumption)	0.927	0.943	0.954	0.873	Reliable & valid
M (Materials & Module)	0.944	0.955	0.953	0.717	Reliable & valid
NT (Trainer & Team Training)	0.944	1.096	0.955	0.780	Reliable & valid

Table 5 presents the evaluation results of construct reliability and validity in the research model. The Cronbach's Alpha values for all constructs ranged between 0.924–1.000, meeting the reliability criteria. Furthermore, rho_A values ranged from 0.751–1.000. Value of rho_A ≥ 0.70 indicates satisfactory reliability, confirming strong internal consistency within the constructs. Regarding Composite Reliability (CR), all constructs showed values above 0.70 (ranging from 0.919 to 1.000). Hair [24] note that CR ≥ 0.70 is acceptable, while values above 0.90 indicate excellent reliability. Therefore, these results confirm that the constructs exhibit adequate internal consistency. The Average Variance Extracted (AVE) for all constructs exceeded 0.50 (ranging from 0.655 to 1.000). An AVE value ≥ 0.50 indicates that a construct explains more than 50% of the variance in its indicators, thereby confirming convergent validity. Overall, all constructs in this research model meet the criteria for reliability and validity, making them suitable for further structural model analysis [24].

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Table 6. CB-SEM analysis results

Path	Path Coefficient (β)	t statistics	p-value	Interpretation
Applications Used → Post-test	-0.696	1.750	0.08	Not significant
Training Duration & Schedule → Post-test	0.097	0.250	0.80	Not significant
Consumption → Post-test	0.289	1.126	0.26	Not significant
Materials & Module → Post-test	0.805	1.955	0.05	Significant (positive effect)
Trainer & Team Training → Post-test	-0.324	1.373	0.17	Not significant

As seen in Table 6, only the Module Variable showed a positive and significant influence on the post-test results ($\beta = 0.805$, $p < 0.05$). Meanwhile, the other four variables did not have a statistically significant effect ($p > 0.05$). This finding indicates that the Module variable plays the most dominant role in influencing participants' post-test performance. This finding aligns with participants' statements that the material in the modules was helpful for understanding the training content, and the language used was clear and easy to understand. Participants also felt that the modules were systematically organized, helping them to understand the material in a more focused and structured manner, thereby making the learning process more effective. These results align with Instructional Design Theory, which states that the quality and structure of instructional materials are key components in supporting learning effectiveness and the achievement of learning outcomes [29], [30]. Additionally, this finding is supported by Ausubel's Advance Organizer concept, which explains that well-organized learning materials can help participants integrate new information with prior knowledge, thereby enhancing understanding and learning outcomes [29]. These findings are also consistent with research by Harianja and Utami [31], Tukiyo [32], and also Ramadhani and Izzati [33], which indicates that instructional materials or modules significantly influence learning outcomes. Cahyadi [34] and Lestari [35] also emphasizes that instructional materials are one of the key factors in determining the quality of learning.

The results of the pre-test and post-test analysis using the paired sample t-test showed a significant improvement in participants' post-test scores, also indicating that the training program was effective in increasing participants' competencies. Furthermore, the CB-SEM analysis revealed that among the five latent constructs training duration and schedule, trainer and team training, materials and module, applications used, and consumption only the *module and materials* variable demonstrated a significant positive effect on post-test performance. This highlights the critical role of well-structured and relevant training materials in facilitating participants' learning outcomes. Participants' feedback also reflected high levels of satisfaction (above 75%) across all dimensions, including training organization, training approach, module, and supporting facilities. The participants agree this training useful for career

development, and they willing to recommend it to colleagues. Participants expressed that they had gained new knowledge and skills and found the training enjoyable and interactive. They also hoped that similar training could continue regularly with a wider variety of topics. This indicates that the planning and implementation of the training were effective and met the intended objectives.

4. Conclusion

The Community Service Program (PKM) conducted by Statistics Study Program, Untan successfully achieved its primary objectives of enhancing participants' knowledge and skills in data visualization and infographic design. The training effectively combined theoretical understanding and practical application using Microsoft Excel and Canva, which were selected for their accessibility and ease of use. This study makes a scientific contribution by demonstrating that the evaluation of community service programs should not focus solely on measuring the effectiveness of training. The application of the paired t-test and CB-SEM provides a more comprehensive evaluation approach because it not only identifies significant improvements in participants' competencies but also examines the factors influencing it. Thus, this study expands the application of quantitative evaluation approaches in community service research, particularly in the context of technology-based training programs.

However, it is possible that this study is not yet perfect. This is based on feedback from participants that the training duration was too short, causing the trainer deliver the material too quickly. This may be one reason why the variables of training duration & schedule and trainer & team training were not significant in influencing participants' learning outcomes. Therefore, future research should consider designing the training duration so that the material can be conveyed more clearly and in greater detail. Overall, this PKM program not only strengthened the partnership between the Statistics Study Program of Tanjungpura University and the IDX West Kalimantan Representative Office but also contributed to improving human resource capacity in capital market literacy and data-based communication. Future programs are recommended to extend practice duration, enhance coordination among facilitators, and explore broader topics related to data analysis and visualization to sustain competency development and educational impact.

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