

Developing a financial dashboard for contextual economics learning in workplace settings

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ABSTRACT

Purpose: to develop, implement, and evaluate a financial dashboard-based learning medium for contextual economics learning in workplace settings, providing an authentic learning environment that supports financial literacy and data-driven decision-making through simulated financial data.

Method: this study adopted a research and development (R&D) approach based on the ADDIE model. A financial dashboard was developed using simulated operational financial data and implemented in a limited workplace learning setting. Data were collected through observations, participants' worksheets, and questionnaires, then analyzed using descriptive qualitative and quantitative methods to assess the usability and initial feasibility of the developed learning media.

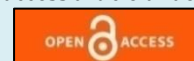
Findings: the developed financial dashboard is feasible for contextual economics learning in workplace settings. The dashboard enabled participants to better understand budgeting, budget variance, cash flow, and operational financial decision-making through simulated financial data. Participants also reported that the visual presentation and guided analysis improved the clarity and relevance of the learning process.

Implications: to the advancement of contextual economics learning by demonstrating the potential of financial dashboards as

Originality: the originality of this study lies in the development of a financial dashboard as a contextual economics learning medium that integrates financial data visualization, workplace learning, and simulated financial data to enhance financial literacy without compromising organizational data confidentiality.



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Introduction

Economics education plays a strategic role in shaping individuals' ability to understand the decision-making process related to choices, opportunity costs, risks, resource allocation, and the economic consequences of each action (Katnic et al., 2024).

These competencies are not only needed in formal educational settings but are also crucial in the increasingly complex and data-driven workplace (Schmidt et al., 2023). In various organizational activities, employees are required to prepare budgets, analyze cost realization, read cash flow statements, evaluate resource efficiency, and support decision-making based on financial information (Tolzmann et al., 2024). Therefore, economics education needs to be developed in a contextualized manner so that students and trainees not only master theoretical concepts but also apply them to real-world workplace situations (Tafner & Casper, 2022).

Advances in information technology have transformed the way organizations manage and present financial information (Ionescu & Diaconita, 2023). A variety of financial data is now available in the form of budget, realization, and cash flow reports, as well as digitized transaction data (Dashkevich et al., 2024). While this information holds significant potential as a learning resource, its presentation, dominated by numbers and tables, often makes it difficult for participants to understand the relationships between financial variables and derive economic meaning from the available data. This situation highlights the need for learning media that can simplify complex financial information into more easily understood visual representations (Cohen et al., 2022). One relevant alternative is the use of financial dashboards, which present data concisely, in a structured, interactive format, enabling participants to identify patterns, compare budgets with realizations, analyze cash flow, and understand the economic implications of various decisions. The use of such visualizations aligns with multimedia learning theory, which posits that integrating text, numbers, and visuals can enhance cognitive processes for understanding complex information (Mayer, 2024; Staneviciene & Žekienė, 2025; Taylor et al., 2023).

The need for contextualized economic learning becomes even more important when learning takes place in a workplace setting (Lejeune et al., 2023). Unlike formal classroom learning, workplace learning emphasizes solving real-world problems directly related to participants' tasks and responsibilities (Stephen & Festus, 2022). Adult learning theory explains that adults tend to learn more effectively when the material being studied is directly related to work experiences, professional needs, and problem-solving encountered in daily practice (Dillard et al., 2024). Furthermore, experiential learning theory emphasizes that direct experience and reflection on that experience are the foundation for meaningful learning (Rahmi, 2024). Therefore, learning media used in the workplace should not only serve to convey information but also facilitate participants' analysis, interpretation, and decision-making based on available data.

Previous research has discussed the development of multimedia-based learning media to improve the effectiveness of the learning process (Tuhuteru et al., 2023; Wideasanti et al., 2023; Yonanda et al., 2024) and explained the importance of implementing systematic learning development models, such as ADDIE, in producing valid and effective media (Lestari et al., 2023). Other research also shows that applying multimedia principles and managing cognitive load can improve participants' understanding of complex material (Çeken & Taşkın, 2025; Liu, 2024). Meanwhile, the literature in financial management addresses more technical aspects of budgeting, financial reporting, and financial statement analysis as part of organizational practice (Farkish et al., 2023; Krüger & Bodemer, 2022). On the other hand, the OECD (2024) report and the Indonesian National Survey of Financial Literacy and Inclusion show that improving financial literacy remains a significant challenge, necessitating a learning

approach that connects economic concepts with real-world financial management practices.

However, studies on the use of financial dashboards as a medium for economics learning in the context of workplace learning are still relatively limited. Most financial dashboards are developed as tools to support managerial decision-making or organizational reporting, rather than as learning media specifically designed to help participants understand economic concepts through financial data analysis activities. Furthermore, the implementation of financial data-based learning in several studies generally still relies on actual organizational data, potentially raising ethical issues, compromising information confidentiality, and limiting access to data. Thus, there remains a research gap regarding the development of economics learning media that integrate financial visualization, contextual learning activities, and realistic yet safe simulated data into the learning process.

This research introduces a novel financial dashboard-based economics learning medium, specifically designed to support contextual learning in the workplace using simulated data. Unlike conventional dashboards oriented towards organizational operational needs, the dashboard developed in this research is designed as a learning medium that integrates financial data visualization with systematic economic analysis, interpretation, and the development of recommendations. The use of simulated data allows participants to gain a learning experience that resembles real-world conditions without involving confidential organizational financial information, making the developed medium safer, more ethical, and more flexible for application in various workplace learning contexts.

In line with this background, this study aims to describe the development process of a financial dashboard-based economics learning media, explain its implementation in workplace learning, and evaluate the media's initial feasibility through a limited implementation. This research is expected to produce learning media that can support a more contextual understanding of economic concepts through financial data analysis activities that resemble professional practice. This research has both theoretical and practical significance. From a theoretical perspective, this study expands the application of multimedia learning theory, adult learning, and experiential learning in the context of workplace-based economics learning. From a practical perspective, this study offers a learning media model that organizations can use as an internal learning tool without risking breaches of financial data confidentiality. Thus, this research is expected to contribute to the development of studies on economics learning media, contextual learning, and workplace learning, while also serving as a reference for media developers and organizations seeking to integrate financial data visualization into economics learning processes more effectively, safely, and relevantly to the needs of the workplace.

Literature review

Constructivism learning theory

Constructivist learning theory views knowledge as actively constructed by students through interactions with the environment, experiences, and reflection on the information they acquire (MacLeod et al., 2022). From a constructivist perspective, learning is not a one-way transfer of knowledge from instructor to student, but rather a process of constructing meaning through which students connect new knowledge with prior knowledge and experiences (Hidayat et al., 2025). Therefore, effective learning must create a learning environment that encourages students to explore information,

analyze problems, interpret data, and develop solutions based on available evidence (Bhardwaj et al., 2025). The application of this theory to economics learning is highly relevant because understanding economic concepts, such as budgeting, costs, revenue, efficiency, and cash flow, is not achieved simply through memorization but requires students' active involvement in analyzing situations that mirror real-world conditions. In this study, a financial dashboard was developed as a learning medium to facilitate this knowledge-construction process by presenting financial data visually, systematically, and contextually, enabling students to understand the relationships among budget planning, financial realization, cash flow, and economic decision-making. Thus, the dashboard not only serves as a medium for presenting information but also as a learning tool that encourages participants to think critically, solve problems, and develop a more meaningful understanding in accordance with the principles of constructivism (Mayer, 2024).

Economic learning media

Learning media are any tools, materials, or means used to convey learning messages so that participants can understand the material more effectively. Tuhuteru et al., (2023) explains that learning media can clarify message presentation, increase attention, and help overcome limitations of space, time, and experience. In economics learning, media is necessary because many concepts are abstract, such as opportunity cost, efficiency, cash flow, profit, risk, and resource allocation decisions (Haghpour et al., 2022). Good economics learning media must meet several characteristics (Wahyuni et al., 2023). First, the media must be appropriate to the learning objectives. Second, the media must display data or situations that are close to the participants' lives. Third, the media must provide opportunities for participants to engage in thinking activities, not just viewing displays. Fourth, the media must include feedback so that participants can determine the appropriateness of their analysis results. Based on these characteristics, financial dashboards can be developed into learning media because they include data, visualizations, guiding questions, and space for interpretation.

Financial dashboard as a visual medium

A financial dashboard is a concise display of key financial information presented through tables, graphs, indicators, and summaries (Gonçalves et al., 2023). In learning activities, the dashboard is not intended as a formal reporting system but rather as a tool to help participants understand the relationships among economic variables (Mahmud, 2023). For example, increases in operating costs can be compared with changes in revenue and cash flow. This comparison helps participants understand that economic decisions cannot be viewed solely from a single number. The advantage of a dashboard as a visual medium lies in its ability to display data in an integrated manner (Souza, 2026). Participants can view the budget plan, realization, differences, variance percentages, cash inflows, cash outflows, and cash balances in a single display. This display helps participants develop systemic understanding, namely the ability to see the relationships between plans, actions, results, and decisions. This principle aligns with the concept of multimedia learning, which places visualization as a support for cognitive processes, especially when the material contains quantitative elements and cause-and-effect relationships (Mayer, 2024).

Workplace learning

Workplace learning is a learning process that utilizes work activities as context, sources of problems, and spaces for application (Stephen & Festus, 2022). This approach positions participants not as passive recipients of material but as individuals who learn through experience, discussion, reflection, and problem-solving (Honra & Villamin, 2026). Rahmi (2024) emphasized that concrete experience, reflection, conceptualization, and active experimentation are essential components of the experiential learning cycle. In this article, workplace learning is implemented through an internal session discussing budgeting and cash flow simulations. Participants are asked to read data, find budget variances, interpret cash positions, and develop recommendations. In this way, the learning media does not stand alone but is integrated with the thought processes typically required in the workplace. This approach is relevant to economics because participants can directly see the usefulness of concepts in decision-making.

Method

This study uses a research and development (R&D) approach to develop an economics learning media based on a financial dashboard, the operational financial learning dashboard. The R&D approach was chosen because the research is not only oriented towards testing theories but also produces learning products that can support the economics learning process in the context of the world of work. The development model used is ADDIE (analysis, design, development, implementation, evaluation). This model was chosen because it provides a systematic and flexible development procedure, starting from needs analysis to product evaluation, so that the resulting media not only has good visual quality, but also suits the learning objectives, participant characteristics, and work environment needs.

The research focused on internal learning activities in the workplace, using operational activities as the context for economic learning. Implementation was limited to internal participants involved in administrative, operational, and simple data management activities. Participants were oriented towards adult learners who needed to strengthen their understanding of economic concepts in their daily work practices. Learning materials integrated into the dashboard included budget preparation, budget realization, cost variance analysis, cash inflows and outflows, cash balances, and recommendations based on the financial analysis results.

The developed media uses simulated data as the primary source of information. The use of simulated data is intended to maintain the confidentiality of organizational information while complying with research ethics. All data is structured to reflect operational transaction patterns commonly encountered in organizations, such as equipment, transportation, and maintenance costs, service receipts, and routine payments. Although not derived from actual organizational data, the simulated data is realistically designed to provide a contextual learning experience and enable participants to conduct economic analyses as they occur in real-world work situations.

The media development process follows the five stages of the ADDIE model (Table 1). In the Analysis stage, the needs for economics learning in the workplace are identified through analysis of material, participant characteristics, and challenges faced in understanding financial information. The Design stage focuses on developing learning objectives, designing the dashboard structure, developing learning scenarios, and developing participant worksheets. Next, in the Development stage, a dashboard is created using a spreadsheet application equipped with simulated data, visualization

graphs, variance indicators, and guiding questions to assist participants in their analysis. The Implementation stage is carried out through limited trials in internal learning sessions using the developed media. The final stage, Evaluation, analyzes the implementation results to identify the media's strengths and weaknesses as a basis for product improvement.

The data collection technique employed several instruments to provide an overview of the media's initial feasibility. Observations were used to observe participant engagement during the learning process, particularly when reading the dashboard, analyzing financial information, and discussing the analysis results. Participant worksheets were used to evaluate participants' ability to identify budget variances, interpret cash flow conditions, and formulate recommendations based on available data. Furthermore, a participant response questionnaire was used to gather information on participants' perceptions of the dashboard display's clarity, ease of use, the material's relevance to their work, and the media's benefits in improving understanding of economic concepts.

Data analysis was conducted using simple qualitative and quantitative descriptive approaches. Observation data and open-ended responses on the worksheet were analyzed through data reduction, grouping findings by theme, presenting data, and drawing conclusions to illustrate the media implementation process. Meanwhile, questionnaire data were analyzed using descriptive statistics, expressed as percentages, to show the distribution of participants' assessments of the media's appearance, ease of use, usefulness, and suitability for learning needs. The analysis results from all instruments were then used to revise and refine the operational finance learning dashboard, ensuring the resulting media is better suited to work-based economics learning.

Table 1 stages of media development based on the ADDIE model

Stage	Development activities	Results obtained
Analysis	Identify economic learning needs in the work process, particularly regarding budgeting and cash flow.	Formulation of contextual, safe, and easy-to-use media requirements.
Design	Develop learning objectives, user flow, dashboard structure, and simulated case scenarios.	Media design, activity flow, and worksheet format.
Development	Create spreadsheet dashboards, simulated data, graphs, variance indicators, and guiding questions..	Initial product of the operational finance learning dashboard.
Implementation	Implement media in limited on-the-job learning sessions.	Participant response data, worksheet results, and observation results.
Evaluation	Analyze implementation results and develop improvements to displays, instructions, and indicators.	Revised product that is clearer and ready for reuse.

Results and discussion

Results of needs analysis

The needs analysis stage is the initial step in the ADDIE model, which aims to identify participant characteristics, learning needs, materials to be developed, and media characteristics appropriate to the workplace learning context. The analysis is conducted through observation of internal learning processes, identification of operational

activities related to financial management, and examination of participants' needs to understand economic concepts used in daily work.

The analysis showed that participants struggled to connect economic concepts to operational financial management practices. The information contained in budget reports, cost realizations, and cash flow statements was generally viewed as a collection of numbers for administrative reporting purposes, rather than as a basis for analysis, evaluation of resource efficiency, or decision-making. This led participants to focus on the bottom line without understanding the relationship between budget, realization, variances, and cash flow as a single unit of economic information.

The analysis also showed that the required learning media must be simple, easy to operate, usable on devices available in the workplace, and support collaborative learning. Furthermore, the media must enable participants to explore data independently, without requiring specialized software. Based on these requirements, a spreadsheet platform was chosen as the basis for media development due to its high accessibility, ease of modification, and ability to integrate tables, formulas, graphs, and data visualizations into a single, structured display.

Another finding suggests that using actual organizational data could potentially raise confidentiality issues. Therefore, the media was designed using simulated data that represents common patterns of operational financial activity, such as budgeted costs, realized expenditures, cash receipts, and routine payments. Despite its simulated nature, the data was structured realistically, providing a contextual learning experience without involving sensitive organizational information.

In addition to media characteristics, the needs analysis also identified the importance of providing learning activities that can guide participants' thinking processes. Observations showed that participants tended to only read numerical values if the media was not equipped with analysis guidance. Therefore, the dashboard was designed with guiding questions that directed participants to identify the causes of budget variances, distinguish between cash surpluses and deficits, evaluate budget efficiency, and develop recommendations based on the data analysis results. The presence of guiding questions was expected to encourage participants to interpret data more deeply than simply reading the available information.

The needs analysis results indicated that the developed learning media needed to meet four key characteristics: contextualization to work activities, ease of use through a spreadsheet platform, security due to the use of simulated data, and the ability to facilitate the analysis process through visualizations and guiding questions. The findings from this stage formed the basis for designing the operational finance learning dashboard in the next design phase.

Operational finance learning dashboard media design

The design phase was conducted based on the results of the needs analysis. The goal was to design a media structure, learning flow, dashboard components, and participant activities appropriate to the context of workplace economics learning. The product developed was named the Operational Finance Learning Dashboard, a spreadsheet-based learning tool designed to help participants understand economic concepts through analysis of operational financial data.

The media design was structured around a systematic learning flow, starting with an introduction to the problem context, understanding the data, analyzing financial information, and developing recommendations. The dashboard consists of several main components: a user manual, simulation data, budget and realization summaries, cash

flow summaries, data visualizations, and analysis sheets. Each component has interrelated learning functions, enabling participants not only to read financial information but also to interpret and make decisions based on the data.

The learning objectives in the media design are directed at participants' ability to understand the relationship between financial planning and realization, calculate and interpret budget variances, analyze cash flow conditions, identify operational financial problems, and develop action recommendations based on the analysis results. These objectives were formulated to meet operational financial literacy needs relevant to work activities.

In terms of appearance, the dashboard design prioritizes readability and ease of use. Information is presented through a combination of summary tables, numerical indicators, and graphic visualizations. Color is used sparingly to differentiate budget information, actuals, variances, and conditions requiring attention. Bar graphs are used to show comparisons between plans and actuals, while line graphs illustrate changes in cash balances over time. The use of these visual elements is designed to enable participants to grasp data patterns more quickly than using numerical tables alone.

In addition to the visual components, the media design includes an analysis sheet with guiding questions. This section guides participants in interpreting data, including identifying the causes of budget deviations, evaluating cash flow conditions, and determining priority actions. With the analysis sheet, learning activities are directed not only at understanding information but also at analytical thinking and decision-making. The design of the main components of the operational finance learning dashboard is presented in Table 2.

Table 2 components of the operational finance learning dashboard media

Component	Content	Learning functions	Learning outputs
User guide	Instructions for using the media, learning objectives, and activity scenarios	Provides guidance on using the dashboard and the learning sequence	Learners understand the procedures for using the learning media
Simulated data	Budget data, actual expenditures, revenues, and operational expenses	Provides datasets for analytical learning activities	Learners are able to identify key financial information
Budget summary	Comparison between planned and actual expenditures for each cost category	Develops learners' ability to interpret and analyze budget variances	Learners are able to identify budget items that are within or exceed the planned allocation
Cash flow summary	Information on cash inflows, cash outflows, and changes in cash balance	Enhances understanding of basic liquidity conditions	Learners are able to analyze cash position and changes in cash balance
Data visualization	Charts comparing budget versus actual expenditures and cash balance trends	Helps learners recognize patterns and trends in financial data	Learners are able to draw conclusions based on data visualizations
Analysis worksheet	Guiding questions and space for formulating recommendations	Encourages data interpretation and evidence-based decision-making	Learners are able to formulate economic recommendations based on their analysis

Based on these design results, the operational finance learning dashboard is designed not only as a medium for presenting financial information but also as a learning environment that integrates data, visualization, and analytical activities. This

design structure serves as the basis for the product development phase, resulting in learning media for use in work-based economics learning.

Forms of media developed

The product of this research is a spreadsheet-based operational finance learning dashboard designed as a contextual economics learning tool in the workplace. This tool was developed by integrating simulated data, financial visualizations, analytical indicators, and reflection activities into a single, structured learning system. Unlike financial dashboards, which are typically used for reporting or managerial decision-making, the dashboard developed in this research is learning-oriented, helping participants understand economic concepts by reading and analyzing data and developing recommendations based on financial information.

The tool is structured into several interconnected sections: a user manual, simulated data, budget and realization summary, cash flow summary, graphic visualization, and analysis sheet. The tool's usage flow is designed to follow the learning stages, starting with understanding the problem context, identifying key financial information, analyzing budget and cash flow conditions, and developing recommended actions. This structure allows participants to follow the learning process step by step rather than focusing solely on the final calculation results.



Figure 1 structure of operational financial learning dashboard media

Figure 1 shows the main structure of the developed media. The dashboard display is designed as a learning flow that guides participants from the orientation stage to the decision-making stage. Participants begin the activity by reading the user manual and understanding the case scenario, then explore the simulated data before moving on to the budget analysis, cash flow analysis, and recommendation development stages. This structure demonstrates that the dashboard functions not only as a display of numerical information but also as a medium that organizes learning activities.



Figure 2 example of budget summary display and variance indicators in the media

Figure 2 shows a budget summary display that compares planned and actual costs. This section includes information on the total budget, total actual costs, variance values, condition indicators, a cost breakdown table, and a visualization comparing items. This presentation allows participants to identify cost components that experience deviations and analyze their possible causes. In addition to numerical information, this display also includes guiding questions to help participants interpret the economic meaning of the data presented.



Figure 3 example of cash flow summary display and analysis sheet on media

Figure 3 shows the cash flow summary and analysis sheet used in the learning activities. The cash flow summary presents information on cash receipts, cash disbursements, and changes in cash balances over a specific period. Meanwhile, the analysis sheet provides space for participants to explain observations, identify problems, and develop recommendations based on the financial conditions found. The combination of data display and analysis activities aims to transform the process of reading financial statements into a more active learning activity. The visual components and learning activities in the media are integrated. Each section of the dashboard serves a specific learning function, ranging from understanding basic information to developing analytical and decision-making skills. Details of the relationship between the media display, learning content, and participant activities are presented in Table 3.

Table 3 inserts media forms and learning activities

Media section	Visual form	Learning content	Participant activities
Instruction page	User instructions and case scenario	Learning objectives, problem context, and activity procedures	Read the learning objectives and understand the case context
Budget summary	Planned-versus-actual budget table, variance indicators, and comparison charts	Budgeting concepts, budget realization, efficiency, and cost variance	Identify the budget items with the largest variance and analyze their causes
Cash flow summary	Cash inflow and outflow tables, and cash balance trend charts	Cash flow, liquidity, and resource allocation priorities	Interpret changes in cash position and evaluate their impact on operational activities
Analysis worksheet	Response fields, guiding questions, and recommendation section	Economic reasoning and data-driven decision-making	Develop recommendations based on the results of the financial analysis

Based on the developed media format, the operational finance learning dashboard integrates visual components with learning activities. The simulated data presentation allows the media to be used in a workplace learning context without using confidential organizational information. At the same time, the dashboard structure maintains the characteristics of operational situations, allowing participants to gain a learning experience relevant to their work needs.

Media product development

The development phase was conducted based on the media design developed during the design phase. At this stage, the Operational Finance Learning Dashboard was developed into a learning product for use in workplace economics learning activities. Product development included compiling simulated data, creating a dashboard structure, integrating calculation formulas, developing data visualizations, and developing analytical activities to support the learning process.

The initial product was developed using a spreadsheet platform because it aligns with implementation requirements: easy access, flexibility for modification, and the ability to integrate various learning elements such as tables, graphs, indicators, and calculation formulas. The dashboard includes data components for the budget, realized costs, cash receipts, cash disbursements, beginning balances, and ending balances. This data is organized in a simulated format based on general operational activity patterns,

allowing it to be used as analytical practice material without involving the organization's actual financial information.

At this stage, various automated calculation functions were also developed to support learning activities. The formulas used include calculating variances between budget and actuals, percentage achievement, and changes in cash position. These calculations are not simply displayed as final results but are presented transparently so participants can understand the relationship between the initial data, the calculation process, and the interpretation of financial information. This approach allows participants to learn the analysis process, rather than simply receiving conclusions from the dashboard.

In addition to the calculation aspect, product development also includes the development of visual indicators to help participants recognize specific financial conditions. Indicators are used to provide early warning signs of conditions that align with plans and those that require further attention. These indicators serve as learning aids, not as absolute standards for financial assessment. Participants are still guided to interpret the causes of changes in value and to develop recommendations based on the problem's context.

The learning materials in the dashboard are developed in a concise, practical format. The economic concepts used include budgeting, realization, variance, cash flow, efficiency, and decision-making. The material is presented not as lengthy theoretical explanations but as case scenarios, simulated data, and analytical questions. This allows participants to directly apply economic concepts through reading and interpreting operational financial data. The flow of learning activities integrated into the operational finance learning dashboard is presented in Table 4.

Table 4 flow of learning activities using the dashboard

Activity stage	Participant activities	Facilitator's role	Activity results
Orientation	Read the learning objectives and understand the case scenario presented on the dashboard	Explain the context of the simulated data and the sequence of learning activities	Learners understand the context of the problem to be analyzed
Data exploration	Examine and identify information from the budget, actual expenditure, and cash flow tables	Guide learners in identifying key financial information	Learners are able to recognize essential financial data related to the problem
Variance analysis	Compare planned and actual figures and identify variances across budget items	Provide guiding questions regarding the causes and implications of the variances	Learners are able to interpret budget variances accurately
Cash flow analysis	Analyze the relationship between cash inflows, cash outflows, and changes in cash balances	Help learners understand the implications of cash positions for operational activities	Learners are able to explain the organization's liquidity condition based on the data
Recommendation development	Formulate alternative actions based on the dashboard analysis	Facilitate discussion and reflection on the analysis results	Learners are able to produce evidence-based recommendations using financial information

The development phase resulted in an initial operational finance learning dashboard that includes key components such as simulated data, a budget summary, a cash flow summary, analysis indicators, graphical visualizations, and participant

worksheets. This product was then used in the implementation phase to gather data on media usability, participant responses, and areas for improvement before wider use.

Implementation of media in work processes

The implementation phase involves applying the Operational Finance Learning Dashboard in limited learning activities within the workplace. Implementation is conducted to assess the media's usability, participant engagement during the learning process, and its ability to support participants' understanding of economic concepts related to operational activities. Participants are adult learners engaged in administrative, operational, or simple information-management activities at work.

The implementation phase begins with an introduction to the learning objectives and the context in which simulated data is used. Participants are introduced to the relationship among budget, realization, cost variance, and cash flow as information to support decision-making. Next, participants use the dashboard to study case scenarios, read financial data, conduct analysis, and develop recommendations based on the available information.

During the implementation process, participants are guided through several key activities: identifying differences between budget and realization, identifying cost components with the largest deviations, analyzing cash flow, and explaining possible actions based on the analysis results. These activities are conducted individually and through discussions, providing participants with the opportunity to compare interpretations and justify their recommendations.

Observations indicate that using the dashboard helps participants understand the relationship between financial data and operational activities. Participants focused not only on the numerical values in the reports but also began to relate this information to resource efficiency, cost control, and action priorities. Presenting data in concise tables and graphs also helped participants more easily identify patterns of budget changes and cash positions.

During the implementation process, several aspects needed improvement. Some participants still needed initial guidance on understanding variance indicators and interpreting the relationships among cash inflows, cash outflows, and ending balances. Furthermore, some participants' recommendations were still descriptive and did not fully articulate the rationale for action priorities. These findings served as the basis for improvements to the user instructions, visual indicators, and analysis sheets. A summary of the results of the limited implementation is presented in Table 5.

Table 5 summary of limited implementation results

Observed aspects	Main findings	Learning significance	Follow-up revisions
Interface readability	Learners were able to follow the main tables but required more consistent color coding.	The visualizations facilitated data interpretation; however, a simpler layout would improve usability.	Refine the indicator color scheme and provide clearer column headings.
Variance analysis	Learners were able to identify the budget item with the largest variance.	The dashboard effectively helped learners distinguish between planned and actual values.	Include an example of variance interpretation in the introductory section.

Observed aspects	Main findings	Learning significance	Follow-up revisions
Cash flow understanding	Learners understood cash inflows and outflows after examining the cash balance chart.	The chart effectively illustrated the organization's cash position.	Add explanatory annotations to the cash balance chart.
Recommendation development	Learners were able to formulate recommendations, although some responses remained descriptive rather than analytical.	The guiding questions should encourage stronger justification and prioritization of proposed actions.	Revise the analysis worksheet by adding sections for rationale and priority setting.

Based on the implementation results, the operational finance learning dashboard demonstrated its capabilities as a tool to support the context-based economics learning process. The tool helped participants connect economic concepts to operational financial management activities through hands-on data analysis experiences. These implementation results were then used as the basis for evaluating and revising the tool to improve display clarity, ease of use, and the effectiveness of learning activities.

Media evaluation and revision

The evaluation phase was conducted to assess the dashboard's functionality after a limited implementation and to identify areas that still needed improvement. The evaluation was based on observations during dashboard use, participants' work on the analysis sheet, and participant responses to aspects of the display, ease of use, clarity of information, and the media's relevance to the needs of economic learning in the workplace. The evaluation results indicated that the Operational Finance Learning Dashboard generally supported the financial data analysis-based learning process. Participants were able to follow the dashboard's flow, understand the key information, and use simulated data to identify problems and develop recommendations. The presentation of information through a combination of tables, indicators, and graphs was deemed helpful in helping participants understand the relationship between budget, realization, and cash flow in a more structured manner.

However, the evaluation also identified several areas for improvement to enhance the dashboard's quality. Regarding the display aspect, some participants needed additional explanation of the function of the color indicators and the meaning of each symbol on the dashboard. Regarding the instructions for use, the media usage steps needed to be simplified to help participants better understand the activity flow independently. Furthermore, the analysis sheet needed further development to encourage participants to provide recommendations that included not only problem descriptions but also rationales, action priorities, and economic considerations. Based on the evaluation results, several revisions were made to the media product. The first revision to the dashboard display simplified the layout, adjusted the use of colors, and added captions to indicators to make the information easier to understand. The second revision to the user manual clarified the sequence of learning activities and provided a brief guide to reading each dashboard component. The third revision to the analysis sheet added space to explain the causes of problems, alternative solutions, and the rationale for selecting the recommendations.

The revisions resulted in an improved version of the Operational Finance Learning Dashboard that is easier to use and more suited to the characteristics of adult

learning in the workplace. The final product not only presents financial information visually but also provides an activity structure that helps participants carry out the analysis process step by step. These improvements provide the media with the flexibility to be reused in different learning scenarios while maintaining the dashboard's core structure. The evaluation phase demonstrated that media development using the ADDIE model allows for continuous improvement based on actual usage results. Evaluation not only assesses product quality but also provides a basis for ensuring that the developed media aligns with learning objectives, participant characteristics, and the needs of economics learning in a work context.

Discussion

This study aims to develop an operational finance learning dashboard as a workplace-based learning medium for contextual economics. The results show that the developed media can integrate simulated data, financial visualization, and analytical activities into a systematic learning environment. During the needs analysis phase, it was found that participants had difficulty connecting economic concepts, such as budgets, cost variances, and cash flow, with daily operational activities. After the media was implemented, observations showed that participants found it easier to identify budget deviations, understand the relationship between cash inflows and outflows, and formulate recommendations based on available data. These findings indicate that using a dashboard can transform the learning process from simply reading financial reports to an analytical process that requires economic reasoning.

These findings support constructivist learning theory, which states that knowledge is actively constructed through experience, interaction, and problem-solving (MacLeod et al., 2022). In this study, participants gained an understanding of economic concepts not only through theoretical explanations but also through direct engagement in reading simulated data, identifying variances, evaluating cash flows, and formulating recommendations. These activities demonstrated that participants constructed new knowledge by connecting the learning experiences on the dashboard with their existing work experience (Braojos et al., 2026; Kasepalu et al., 2022). Thus, the dashboard serves as a learning environment that facilitates knowledge construction, not merely as a medium for conveying information.

The implementation results show that the presence of guiding questions on the dashboard is crucial to driving the knowledge construction process. During the needs analysis phase, it was found that without analytical guidance, participants tended to focus solely on the final values in the financial statements. After the dashboard was supplemented with questions about the causes of variance, cash flow conditions, and alternative actions, participants began to demonstrate the ability to identify cause-and-effect relationships among financial indicators. This finding demonstrates that the learning process does not occur solely through data presentation, but through reflective activity that guides participants in constructing meaning from the available information. These results reinforce the constructivist view that effective learning media are not those that present as much information as possible, but rather those that facilitate participants' thinking as they construct their own knowledge (Angelelli et al., 2023; Jaleniauskiene & Kasperuniene, 2023).

The findings of this study also align with experiential learning theory. The theory explains that learning occurs through four interrelated stages: concrete experience, reflective observation, abstract conceptualization, and active experimentation (Cheng et al., 2025; Rahmi, 2024). These four stages were evident during the media's

implementation. The simulated data in the dashboard provided participants with a concrete experience by depicting operational situations that resembled real-world workplace conditions. When participants read the budget summary, compared actual results with plans, and observed changes in cash balances, they engaged in reflective observation. Furthermore, participants began to understand variance, budget efficiency, and liquidity as abstract concepts. In the final stage, participants developed cost-control recommendations and cash-utilization priorities as a form of active experimentation. Thus, the dashboard not only conveyed economic information but also facilitated an experiential learning cycle.

From an andragogical perspective, research findings indicate that the learning context significantly influences participant engagement. Green (2024) explain that adult learners are more motivated when the material being studied is directly related to work needs and real-life problem-solving. Implementation results indicate that participants more easily grasp economic concepts when the material is presented through operational budget, cost realization, and cash flow cases that resemble daily work activities. Participants no longer view the budget as merely an administrative document, but as an instrument for evaluating the efficiency of resource use. Similarly, cash flow is understood not only as a record of income and expenses, but as a basis for determining operational decision priorities. These findings demonstrate that economics learning becomes more meaningful when directly linked to work contexts familiar to participants.

Another advantage of the developed media lies in the use of simulated data as a learning resource. During the needs analysis phase, it was identified that the direct use of organizational financial data could raise ethical and confidentiality concerns. Therefore, this study used simulated data designed to resemble real operational transaction patterns. Implementation results indicate that this approach still provides an authentic learning experience, as participants can analyze financial conditions without accessing sensitive organizational information. This finding makes a practical contribution by demonstrating that work-based learning can still be implemented in context without compromising organizational data security.

From a multimedia learning theory perspective, the research findings indicate that a combination of tables, visual indicators, graphs, and guiding questions helps participants understand complex financial information. Mayer (2024) explains that information is more easily processed when presented through a combination of complementary verbal and visual representations. Implementation findings indicate that participants were quicker to identify budget deviations using bar graphs than when simply reading numerical tables. Similarly, graphs of changes in cash balances helped participants better understand cash flow dynamics. Observations also indicate that after the dashboard display was revised during the evaluation phase, participants improved their ability to read indicators and follow the analysis flow. This suggests that the quality of visual design is a crucial factor in supporting information processing and reducing cognitive load when participants study financial data.

The results of this study also extend prior research on learning dashboards. Paulsen & Lindsay (2024) demonstrated, through a systematic review, that the development of educational dashboards has shifted from simply displaying analytics to dashboards oriented towards learning processes, reflection, and participant action. The dashboard developed in this study exhibits similar characteristics, as it not only presents budget and cash flow information but also provides guiding questions, analytical space, and recommendation-making activities. Thus, the dashboard functions

as a pedagogical medium that supports knowledge formation, rather than simply a data visualization tool.

On the other hand, a systematic review conducted by Kaliisa et al. (2024) showed that the effectiveness of learning dashboards is not solely determined by technological sophistication, but by how the dashboard encourages participant engagement in the learning process. The study found that dashboards tend to have a more consistent impact on participation and engagement than on improving learning outcomes when not accompanied by adequate learning strategies. This finding is relevant to this study because dashboards are not used as stand-alone learning media but are instead combined with discussions, reflective questions, and analytical activities that require participants to provide a rationale for their recommendations. Thus, participants' understanding is influenced not only by the dashboard's visualization but also by the design of the accompanying learning activities.

The results of this study also reinforce a new trend in the development of learning analytics dashboards. According to Paulsen & Lindsay (2024), effective dashboards should be designed on pedagogical principles and provide actionable feedback to help participants make learning decisions. This is exemplified by the financial operations learning dashboard, which not only presents financial indicators but also guides participants in identifying problems and their causes, and in determining alternative courses of action. Therefore, the dashboard developed in this study is closer to the concept of a student-focused dashboard than to one that functions solely as a reporting medium.

The primary contribution of this research lies in the development of a dashboard as a work-based economics learning medium. Most previous research has developed dashboards to support learning analytics in formal educational settings or to serve as learning process monitoring tools. In contrast, this research adapts the dashboard concept to workplace economics learning by using simulated data that represent an organization's operational activities. This approach expands the dashboard's function from an analytical instrument to a pedagogical tool that helps adult learners understand economic concepts through authentic work experiences.

Overall, the research findings demonstrate that the operational finance learning dashboard is an innovative learning medium that integrates the principles of constructivism, experiential learning, adult learning, and multimedia learning into a single data-driven learning design. This integration enables abstract economic concepts to be translated into concrete, contextual, and relevant learning experiences tailored to participants' workplace needs, while also expanding the use of dashboards as a learning medium for economics in workplace learning contexts.

Conclusions

This research successfully developed an operational finance learning dashboard, a dashboard-based economics learning tool designed to support contextual learning in the workplace. Through the ADDIE model, the tool was systematically developed, starting with needs analysis, design, development, implementation, and evaluation. Implementation results indicate that the dashboard can help participants understand economic concepts related to budgeting, realization, cost variances, and cash flow through simulated data, information visualization, and structured analysis activities. The integration of tables, graphs, visual indicators, and guiding questions encourages participants not only to read financial data but also to interpret the information, identify problems, and develop evidence-based recommendations. These findings demonstrate

that dashboards can function not only as data visualization tools but also as learning tools that facilitate knowledge construction, experiential learning, and decision-making in the workplace.

This research provides theoretical and practical contributions to the development of economics learning tools. Theoretically, the research findings strengthen the application of Constructivism Theory, Experiential Learning Theory, Adult Learning Theory, and Multimedia Learning Theory in the development of dashboard-based learning tools. The integration of these four perspectives demonstrates that economics learning becomes more meaningful when participants actively interact with data relevant to their work context. Practically, this research offers an alternative, secure learning medium using simulated data, enabling its application to internal organizational learning without accessing confidential financial data. Furthermore, this research expands the dashboard's functionality from a mere reporting and data visualization tool to a pedagogical tool that supports the improvement of operational financial literacy in the workplace. However, this research still has limitations because the implementation was carried out on a limited scale, with a relatively small number of participants, and focused on a single workplace. The research evaluation also focused on media usability and participant responses, and thus did not comprehensively measure the impact of dashboard use on learning outcomes, economic literacy, or decision-making quality.

Based on these limitations, further research is recommended to test the effectiveness of the Operational Financial Learning Dashboard through an experimental or quasi-experimental design involving a larger number of participants, more diverse organizational characteristics, and a longer implementation period. Future research could also develop more interactive, technology-based dashboards, such as those integrated with business intelligence, a learning management system (LMS), or learning analytics, to enable real-time feedback and personalized learning. Furthermore, further research is needed to measure the impact of dashboard use on financial literacy, critical thinking, data analysis, and the quality of economic decision-making, using more comprehensive indicators. This development is expected to strengthen empirical evidence on the effectiveness of dashboards as a learning tool in economics and expand their application across various learning contexts in the workplace and formal education.

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