

Strengthening Student Network Competence through the MikroTik Academy Program: Evaluation of the CIRO Model

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Abstract

The rapid development of Industry 4.0 and Society 5.0 requires higher education institutions to produce graduates with strong digital competencies supported by internationally recognized professional certifications. One strategic effort to address this demand is the implementation of the MikroTik Academy program, which provides students with the MikroTik Certified Network Associate (MTCNA) certification. This study aims to evaluate the effectiveness of the MikroTik Academy program in strengthening students' network competence using the CIRO (Context, Input, Reaction, and Outcome) evaluation model. A mixed descriptive approach was employed, involving questionnaires, interviews, observations, and documentation. Data were analyzed using qualitative techniques and descriptive quantitative statistics. The results indicate that the program is highly relevant to student needs and industry demands (context), supported by qualified instructors, standardized training materials, and adequate facilities (input). Participants showed positive responses in terms of learning comfort, clarity of instruction, and increased self-confidence (reaction). In terms of outcomes, the program achieved a very high certification pass rate (96–100%), improved students' professional readiness, and contributed significantly to institutional key performance indicators related to graduate employability and off-campus learning experiences. Overall, the findings demonstrate that the MTCNA certification program is effective, sustainable, and strategically valuable for enhancing graduate competitiveness and institutional quality.

Keywords

CIRO Evaluation Model; MTCNA Certification; Network Competence.



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INTRODUCTION

Technological developments in the Industrial Revolution 4.0 and Society 5.0 eras require universities to produce graduates with high adaptability, digital competency, and globally recognized professional certifications. According to UNESCO (2022), technological competency and professional certification are essential components of 21st-century skills and key to the work readiness of the younger generation during the digital transition. Consistent with this view, the OECD (2023) emphasizes that competency recognition through international certification is a crucial indicator in increasing graduate employability and competitiveness in the global job market. Today's industry demands Informatics graduates who not only master theory but also possess technical skills proven through professional

certification. One globally recognized certification is the MikroTik Certified Network Associate (MTCNA), which sets the standard for basic competency in configuring RouterOS and network devices. This certification is considered essential because it provides evidence of the practical skills needed in the modern workplace (Hidayat et al., 2021).

This aligns with the mandate of Law Number 13 of 2003 concerning Manpower, which emphasizes that work competencies encompass knowledge, skills, and attitude. Furthermore, universities are required to improve performance through Key Performance Indicators (KPI), specifically KPI 1 (graduates find decent jobs) and KPI 2 (students gain off-campus learning experience). International certification serves as formal evidence that can strengthen graduate quality, increase competitiveness, and facilitate an easier transition into the workforce. International certification serves as authentic proof of competency, a means of differentiating graduates in the job market, and a strategic instrument for meeting KPIs and strengthening institutional accreditation.

To address this need, the Informatics Education Study Program at the University of PGRI West Sumatra, in collaboration with MikroTiks SIA, a Latvian technology company, is organizing the MikroTik Academy, an official educational program aimed at educational institutions such as vocational schools, polytechnics, or universities, to learn and obtain certification in computer networking using MikroTik products. This program equips students with strong practical and theoretical knowledge, as well as providing opportunities to obtain international certifications such as the MikroTik Certified Network Associate (MTCNA).

This program is part of a strategic effort to improve the quality and competitiveness of graduates and strengthen the institution's position in the higher education competition. However, the implementation of the training requires a comprehensive evaluation to ensure its effectiveness, including its suitability to participant needs, the appropriateness of program input, student responses during the training, and its impact on improving their competencies (Guskey, 2000).

Therefore, the CIRO Model is used as an evaluation framework because it can comprehensively assess training through four aspects: context, input, reaction, and outcome. This model is considered suitable for evaluating technical certification-based programs such as the MTCNA, which require high relevance and accurate outcome measurement (Warr, Bird, & Rackham, 1970). Through this evaluation, it is hoped that an objective picture of the program's success will be obtained, as well as recommendations for improvements in future MTCNA training implementation.

The purpose of this MTCNA training program evaluation is to analyze the suitability of the MTCNA training objectives and needs with student profiles and industry competency demands in the field of computer networking. It is hoped that this will contribute to the development of evaluation studies of certification-based training programs using the CIRO model. The findings of this study are expected to enrich the literature on the effectiveness of technical training in higher education environments, particularly in the field of computer networking.

METHODS

The evaluation model used in evaluating the MikroTik Academy program at PGRI University of West Sumatra is the CIRO model. The CIRO model was developed by Warr, Bird, & Rackham (1970) as an approach to assessing the effectiveness of training and educational programs. CIRO is an acronym for four evaluation components: Context, Input, Reaction, and Outcome. Unlike other evaluation models such as Kirkpatrick's, CIRO emphasizes assessment from the planning stage to long-term impact, making it suitable for comprehensive program evaluation.

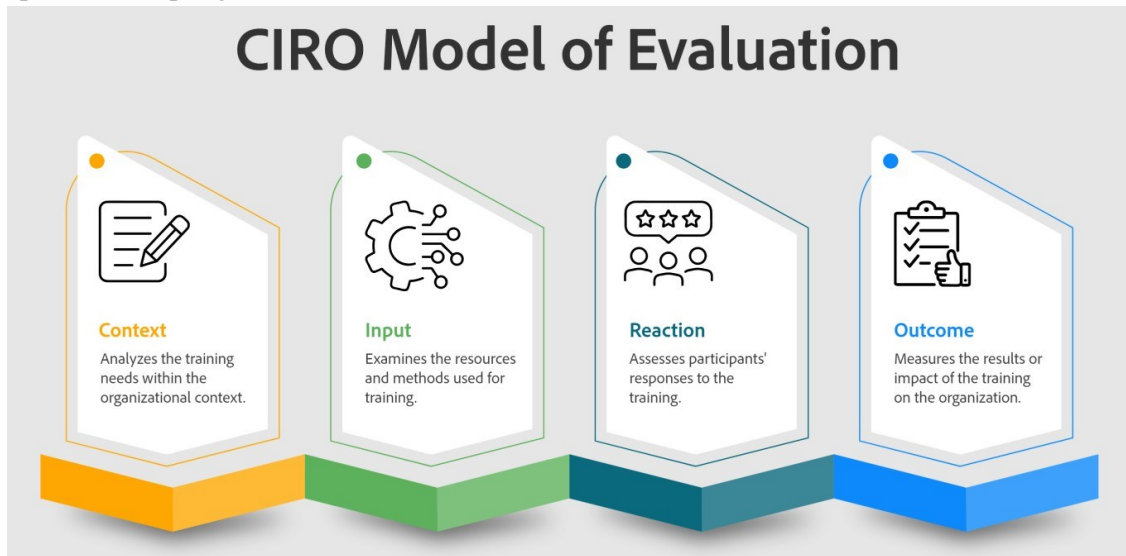


Figure 1. CIRO Model of Evaluation by DB Brown

The CIRO model was chosen because it provides a comprehensive evaluation approach, starting from needs analysis to the impact of training outcomes, so it can be used to assess the effectiveness of a program and formulate recommendations for improvement. According to Warr, Bird & Rackham (1970), the main purpose of CIRO evaluation is to provide a comprehensive picture of the success of a training program based on input, participant responses, and its impact on improving participant capabilities. In the current era, CIRO has become a popular evaluation method for assessing competency-based training programs, because it not only assesses the final results, but also the implementation process and the level of participant acceptance (Newstrom & Broad, 2002).

The data sources and data collection instruments used for the evaluation of the MikroTik Academy UPGRISBA program using the CIRO model are Context Evaluation, Input Evaluation, Reaction Evaluation, and Outcome Evaluation. Data analysis was conducted using qualitative and quantitative descriptive methods according to the characteristics of the data collected. Data from interviews, observations, and documentation were analyzed through the stages of data reduction, data presentation, and conclusion drawing. This technique was used to describe the program context, input readiness, and outcomes narratively. Data from the questionnaire were analyzed using descriptive statistics, such as percentages, to see the

tendency of participant reactions or their level of satisfaction with the program. The questionnaire scores were then interpreted using certain categories (very good, good, sufficient, less).

FINDINGS AND DISCUSSION

Context Evaluation

The Mikrotik Certified Network Associate (MTCNA) international certification program was established in response to the need to improve student competency to meet the increasingly competitive demands of the digital age. At the student level, the need for professional certification is growing, as competency certificates have become a key requirement in industry recruitment processes, particularly in the fields of computer networking and information technology. This is reinforced by interviews and participant testimonials, which state that the program is "very useful as a certificate to accompany graduates in their job search" and "increases self-confidence to compete in the industrial world."

From an institutional perspective, the certification program is part of a strategy to improve academic quality and graduate competitiveness, while also supporting the achievement of Higher Education Key Performance Indicators (KPI), particularly KPI 1, which focuses on graduates' attainment of decent employment, and KPI 2, which focuses on off-campus learning experiences. Both indicators serve as important benchmarks for improving the institution's accreditation and reputation.

The implementation of this program is also relevant to the direction of education policy in the Industrial Revolution 4.0 and Society 5.0 eras, where universities are required to produce graduates with digital competencies and professional certifications based on industry standards. This aligns with the OECD (2023) statement that technical competency certification plays a crucial role in increasing graduate employability and expanding access to global job opportunities.

The survey results showed that participants' perceptions of the Mikrotik certification program were in the good category, with a percentage of 75.37%. This finding indicates that the training was designed with systematic and focused planning. This score illustrates that participants had a positive view of the training implementation, from the formulation of objectives and explanation of training instructions to the structured schedule design. Therefore, administratively and pedagogically, the training program met the basic aspects of certification program planning.

These findings also demonstrate a high level of relevance between the training provided and participants' needs. This is reflected in participants' statements that the material presented is aligned with current developments in network technology. This relevance is important because it indicates that the training is not only theoretical but also contextual in addressing job market needs and industry developments. The relevance of this training also demonstrates a link between program design and increasing participants' capacity in networking

competencies, which ultimately can enhance participants' competitiveness in the workplace.

Furthermore, participants also gave positive feedback on the procedural aspects and the training flow, which they deemed easy to understand. This indicates that the program met the principles of clarity and accessibility in training design. This success can be attributed to systematic training planning, from material development to instructional delivery.

These findings, based on an interview with the training instructor, Ms. Ami Anggraini Samudra, M.Sc., explained that training preparation included the creation of modules, videos, and practice questions. This preparation demonstrates an effort to provide varied learning resources based on participants' learning experiences. Thus, there is consistency between the survey results and the qualitative findings, indicating that training preparation and implementation contributed to participants' positive perceptions.

Overall, the evaluation results indicate that the training was well-designed, relevant to participants' needs, and had a clear process and implementation flow. However, the 75.37% score also implicitly suggests that there is room for improvement, both in terms of the effectiveness of learning media and in optimizing the practical supervision process to ensure participants' continued technical competency development.

Input Evaluation

The MTCNA certification program is designed to utilize adequate academic resources and supporting facilities to ensure the effectiveness of the training and examination process. All training materials utilize official modules and syllabi published directly by MikroTik, ensuring that the competencies taught align with global standards set by the vendor.

The training instructors are internationally certified MikroTik Trainers, namely Ami Anggraini Samudra, S.Pd., M.Sc., MTCNA., MTCRE. They play a crucial role in knowledge transfer and mentoring during training and certification exams. With these qualifications, the training is supervised by competent professionals and meets the MikroTik Academy requirements.

Participants are active students in the Informatics Education Study Program who have taken the Computer Networks course and met the academic requirements. The training process is integrated with the course curriculum and followed by specialized training (bootcamp) to prepare participants for the certification exam. The implementation process is systematically structured based on a schedule of activities outlined in the implementation agenda table.

The certification exam was conducted online using the official MikroTik platform in the Informatics Education Study Program computer laboratory, with a 60-minute exam duration for each participant and a real-time assessment mechanism. Based on activity reports, the implementation of the training and exam went according to plan without significant obstacles, with a very high pass rate in both implementation periods. Thus, the input aspect shows that the program implementation has met the key requirements of competency-based training, namely: the availability of expert instructors, an industry-standard curriculum, adequate facilities, and participants who meet the initial competency standards.



Figure 1. MTCNA Training (May 6-8, 2024)

Interviews with the Head of the Informatics Education Study Program indicate that the MTCNA certification training is conducted routinely twice a year and is provided for four days as an enrichment program. This information indicates that the training has become part of the study program planning, not an incidental activity. Furthermore, the integration of MTCNA material into the curriculum through courses demonstrates a synergy between training activities and the formal learning process. Among the supporting courses are basic computer networks, advanced computer networks, wireless networks, network infrastructure administration, and network management. This reinforces the assumption that the training is not merely supplementary, but functions as a form of improving student competency through a continuous learning path.

However, interviews also revealed challenges related to participant motivation. High-ability students tended to be less motivated to participate in the training because they felt they had already learned the material through lectures. This suggests a phenomenon of "overlapping content," which could potentially lead to boredom or a perception of redundancy in the training. The head of the study program explained the solution, which was to provide links to materials so participants could study independently. This strategy reflects an effort to accommodate the learning needs of participants with varying abilities, although its effectiveness still requires further evaluation. These findings also indicate that the success of the training is determined not only by the availability of materials, but also by motivational strategies and pedagogical approaches for participants with heterogeneous abilities.



Figure 2. Examination implementation (14-18 October 2024)

The interview findings align with the survey results regarding participant satisfaction with the training, which scored 77.05% and is in the good category. This score indicates that the training program has met most participant expectations, particularly regarding the quality of material delivery and instructor assessments. Furthermore, adequate laboratory facilities and supporting infrastructure, such as classrooms and a smooth internet connection, significantly contributed to participant satisfaction. Optimal facilities and learning resources are crucial aspects of computer networking practice-based training, and therefore, the survey results can be understood as an indicator of the training management's success in providing a conducive learning environment.



Figure 3. Group photo of exam participants

When compared with the interview results, both findings consistently demonstrate that the training was well-designed and received a positive response from participants. However, the interview results also revealed a challenge not fully addressed by the survey data: the motivation of highly competent participants. This indicates that training success can be measured not only by satisfaction and facilities but also requires classroom management strategies and learning differentiation to ensure that all participants receive optimal benefits.

Overall, the combined results of the survey and interviews indicate that the MTCNA certification training was effective in terms of planning, implementation, and facilities. However, there is room for improvement, particularly in terms of managing motivation and designing differentiated learning experiences for participants with diverse abilities. Therefore, this evaluation recommends refining the pedagogical strategy to more comprehensively accommodate the characteristics of the training participants.

Reaction Evaluation

Participants' reactions to the MTCNA certification program were overwhelmingly positive. Based on interviews and brief reflections, the program was deemed highly beneficial, relevant to the needs of the workplace, and provided a meaningful and applicable learning experience. Participants stated that the training not only provided new knowledge but also increased their confidence in facing the professional world. This is evident in the following testimonials:

"The MTCNA certification program is excellent and provided new experiences I wouldn't have gotten in a regular class. The training is clear, structured, and applicable to the workplace."

"This training is very beneficial because it not only increases technical knowledge but also provides an international certificate that can accompany a diploma when applying for jobs."

"Overall, this program is very good and should be continued, because it really helps us compete in the industrial world and increases our confidence as prospective graduates."

These testimonials demonstrate that the certification program is highly beneficial and well-received by participants. This testimony is further supported by the results of a participant experience survey.

The questionnaire results showed that 76.17% of participants' experiences during the MTCNA training and certification program were considered good. Quantitatively, this figure indicates that participants had a positive learning experience during the training. This achievement reflects the training program's ability to provide a relevant, adaptive learning experience that supports participants' needs.

1. Comfort Conditions and Learning Environment

The statement that participants felt comfortable participating in the training indicates that the learning environment, facilities, and interactions with instructors have been managed effectively. In the context of certification training, comfort during the training is an indicator of success because it contributes to participant engagement and readiness to participate in the learning process.

The comfort felt by the participants also shows that the training is not only oriented towards knowledge transfer, but also pays attention to the affective aspects of the participants as an important part of the learning experience.

2. Clarity of Instructions and Assessment Procedures

Participants were able to understand the assessment instructions well. This indicates that the activity flow, work instructions, and evaluation mechanisms were implemented clearly and systematically. This finding is important because good instruction quality will encourage participants to master the material more deeply, especially for competency-based certifications like the MTCNA.

On the other hand, this clarity also indicates that the training materials and delivery methods have been structured to support the participants' overall learning experience.

3. Increased Participants' Self-Confidence

Participants also experienced increased self-confidence after participating in the MTCNA training and certification. Theoretically, increased self-confidence is a consequence of a successful and meaningful learning experience. This demonstrates that the training impacts not only technical knowledge but also psychological aspects of participants. This increased self-confidence indicates that the training has successfully enhanced participants' self-efficacy in facing challenges in the field of computer networking.

Overall, the results of the participant experience questionnaire indicated that the MTCNA training program provided a positive learning experience in terms of comfort, clarity

of instruction, increased confidence, and motivation to pursue certification. These findings also reinforce that the program is not only technically effective, but also psychologically and professionally effective for participants.

Outcome Evaluation

The implementation of the MTCNA international certification program in 2024 demonstrated excellent results, both in terms of increased enrollment and completion rates. Quantitative data demonstrates that the program not only successfully improved students' skills but also had a direct impact on their readiness to enter the workforce. According to the implementation report:

-The May 2024 period was attended by 20 participants, with the result that 100% of participants passed the certification.

-The October 2024 period was attended by 46 participants, with 96% of participants successfully passing the certification.

In addition to the quantitative impact, the training's results were also demonstrated in increased student confidence and preparedness for job selection. This is supported by participant testimonials, including:

"This program is very useful as a companion certificate for graduates in finding work."

"In general, this program is very good from the students' perspective and should be continued."

This testimony is supported by the survey results of 76.11% who were satisfied with this program and had a positive impact on improving the participants' abilities such as using Winbox, Mikrotik Tools, troubleshooting so that they were more confident.

By holding an international certificate valid for three years, students gain added value compared to graduates without professional certification. This certification serves as authentic proof of a prospective worker's competence and strengthens their bargaining power in the job market.

From an institutional perspective, the outcomes of this program have a strategic impact on the achievement of Higher Education Key Performance Indicators (KPI), especially: 1) KPI 1; Graduates get decent jobs; 2) KPI 2; Students get learning experiences outside the campus, 3) Strengthening the accreditation of study programs and institutions

In addition, the success of this program opens up strategic opportunities for: 1) Development of advanced certifications such as Cyber Security, Cloud Computing, Network Engineer; 2) Opening public classes (income-generating programs); 3) Establishing international certification as a mandatory program for students; 4) Long-term target to achieve 60 certified students per year. Thus, the results of the outcome evaluation show that the implementation of MTCNA certification has a significant impact on both student quality and the institution's reputation.

The finding that participants expressed a desire to pursue further certification demonstrates the continued impact of the training. This demonstrates that the training provided a positive experience and fostered participants' professional development. From a training evaluation perspective, this context can be categorized as a higher-level outcome, as

the training has impacted participants' motivation and career orientation. This is an important indicator that the training is sustainable and relevant to participants' future needs.

Information from the Head of the Informatics Education Study Program reinforces the training evaluation results, which show that the MTCNA certification not only provides benefits in terms of technical knowledge and skills but also has strategic value in the career development of graduates. The statement that the MTCNA certificate provides graduates with the capital to obtain employment in industry and education reflects the training program's external relevance to job market needs.

These findings align with survey results, which showed that participants who graduated and obtained certification experienced significant benefits, particularly in the form of improved professional competency. Certification serves as credentialing, demonstrating participants possess international-standard competency in MikroTik-based network management. Practically, this provides graduates with added value in the job market and provides a competitive advantage over uncertified graduates.

From an outcome evaluation perspective, the benefits experienced by participants after receiving their certificates demonstrate that the training not only improves technical skills but also contributes to their job readiness. Participants gain practical experience and knowledge relevant to the demands of today's networking industry, ultimately enhancing their job opportunities and career development.

Thus, based on the quantitative data and qualitative information obtained, it can be concluded that the MTCNA training and certification program has long-term benefits and strategic value. This program not only prepares participants for the certification exam but also provides professional competencies relevant to the needs of the real world of work.

CONCLUSION

Based on the evaluation of the Mikrotik Certified Network Associate (MTCNA) international certification program using the CIRO model, it can be concluded that this program is highly relevant to the needs of improving student competency in computer networking in the Industry 4.0 and Society 5.0 eras. Training resources meet high standards: internationally certified instructors, official MikroTik training modules, and representative laboratory facilities. Participant feedback was very positive, demonstrated through testimonials that the program was beneficial in increasing graduates' confidence and marketability in the workforce. The impact of the training results was significant; the number of participants increased by more than 100% in a short period; the graduation rate was very high (96–100%); and it made a significant contribution to KPI 1 & KPI 2 and strengthened accreditation. This program has proven effective, sustainable, and has high institutional value for developing the university's reputation and enhancing graduates' job readiness.

To maintain and enhance the program's success, the following steps are recommended: Certification should be made mandatory for students. It should be established as part of the curriculum/graduation requirements for networking competency areas. New certifications,

such as Cyber Security, Cloud Computing, and Network Engineer (advanced level), should be added.

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