

APPLYING DMAIC FRAMEWORK FOR DESIGNING PERSONALIZED TRAINING PROGRAMS IN THE IT INDUSTRY

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Abstract

In today's fast-paced world of progressive workforce training, companies are increasingly oriented to the utilization of innovative technologies like virtual reality (VR) and augmented reality (AR) or Artificial Intelligence (AI), to enhance the learning experience for their employees. The necessity for well-structured training program development, customized to fulfill the specific gap in the workforce's knowledge and skills evolved as one of the key organizational priorities, especially in the rapidly growing IT industry. Yet, adopting new and advanced concepts brings numerous benefits alongside barriers and difficulties due to employees' different levels of proficiency. Personalized learning not only enhances involvement but also ensures that employees receive targeted training that directly addresses their specific knowledge and skill gaps in a particular field. This paper aims to identify the current steps in designing personalized development programs tailored to the employees' experience and learning background, driven by the Six Sigma DMAIC methodology. For this purpose, the presented conceptual model is extended by integrating the DMAIC approach into the structuring of personalized training programs. The model was validated through face-to-face interviews with representatives of the Macedonian IT industry business community.

Keywords: Conceptual model, DMAIC methodology, Employees, Personalization, Training programs.

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1. INTRODUCTION

The increasingly rapid growth of advanced and innovative technologies implicates the need for appropriate adoption of business-changing practices (Lindström et al., 2023). Organizations should be responsible for effective development programs to enhance the level of employees' productivity. The training of employees is crucial for achieving overall organizational success. Additionally, it ensures that employees are adaptive to a dynamic work environment and inculcates core skills for high performance (O'Really et al. 2019). Yet, traditional workplace training methods tend to be uniform and fixed, and they cannot meet the individual needs of various employees. In this context, the implementation of advanced technologies provides new opportunities to solve these problems. Integrating advanced technologies such as Artificial

intelligence (AI) contributes to the creative design of employee training, thus making the coaching more efficient (Stanisavljev et al., 2021). Actually, the rise of cutting-edge technologies opens up new opportunities related to the workforce and includes a wide range of applications within the area of Human Resource Management. For instance, AI tools have been applied to the recruitment process to facilitate job application, selection practices, and talent onboarding (Rodney et al., 2019; Sivathanu & Pillai, 2018). AI technology can also be used for the evaluation and optimization of training effects, through employee behavior analysis and data mining technology, the training outcomes can be quantitatively assessed. Parallel, merged with machine learning algorithms, the training programs and content can be customized and adjusted to the employees' learning background (Na, 2023). Likewise, big data algorithmic analytics, sensory, and tracking technologies have risen as AI-based decision-making technologies in the workplace (Nica et al., 2019). AI's growing potential can be seen as an opportunity for advancement and successful coping with work-related challenges (Arslan et al., 2021).

However, one of the major challenges is to design training and development programs tailored to the employees' needs and knowledge gaps, particularly in the fast-evolving IT sector (Kraft & Blazar, 2018). At the same time, one of the common issues for organizational leaders is to face with the absence of individualized learning (Sucharita & Seethalakshmi, 2022). The training and development initiatives strongly prioritize employees' overall personality development (Siddiqui & Sahar, 2019). Besides that, appropriately structured training programs focused on personalization and customization help employees to facilitate the effective integration of acquired knowledge into the workplace. Personalized training program is a data-driven program. It includes collecting data for the current level of skills and customize the training program according to the employees needs addressing the desired level of skills. In that sense, the implementation of AI tools in coaching offers transformative potential for education. The ability of AI to provide personalized training experiences tailored to individual employee needs is a significant benefit. Adaptive learning platforms, powered by sophisticated AI algorithms, can analyze employees' performance data in real-time, offering customized content and feedback. Such tailored educational experiences can address diverse learning needs and help bridge gaps in knowledge, making education more inclusive and effective (Akavova et al., 2023). Some companies use online virtual reality technology to provide employees with realistic workplace scenario simulations, allowing them to train and practice in a virtual environment (Na, 2023). Moreover, an augmented reality can be used to support employees building up the required competences. It represent an innovative learning media that enable new learning scenarios due to their technological possibilities (Sorko & Brunnhofer, 2019). Both technologies, virtual reality and augmented reality, offer a number of affordances such as providing familiarity with the associated real-world environment.

On the other hand, numerous researchers confirm that the implementation of the Six Sigma methodology creates a successful employee training process (Singh & Rath, 2019). It is more than clear that the training and development process requires adequate planning to identify training needs, skill gaps, and the type of training required to ensure an effective program that solves the problem. In this context, the Six Sigma technique ensures continuous support, sustaining performance, and evaluating objectives achievement (Alhosani & Tariq, 2020). This is supported by the five Sigma driving cycle, Defining, Measuring, Analyzing, Improving, and Controlling. Based on these findings, employee training organizations could also explore the Six Sigma capabilities to enhance their task performance (Agbaeze et al. 2019).

Although the usefulness of the integration of appropriate technologies in the training and development process cannot be denied, the methodological steps remain as questions as to how it can be enabled. A systematic literature review identified a research gap in identifying the steps in designing the training and development programs tailored to the employee's current knowledge, skills, and experience using advanced technologies such as AI. Yet, the methodological steps remain as questions as to how it can be enabled. Specifically, the considered research problem focuses on answering the question: What are the current steps in structuring personalized development programs in the context of cutting-edge technologies, and may the Six Sigma methodology serve as a driver in designing training programs? In particular, the paper aims to identify the steps of the development of personalized development programs tailored to the employees' needs, defined according to the DMAIC Six Sigma cycle. In that sense, the goal of this research is to use the DMAIC framework to determine the methodological steps in designing employees' personalized development programs incorporating advanced technologies.

2. LITERATURE REVIEW

Due to developments in the current dynamic business environment which is more global and competitive than ever, employees' training and development, and the way organizations support their continuous development are pivotal (Stentoft & Rajkumar, 2020; Ahmad et al. 2020; Kavalić et al., 2021; Lejeune et al., 2016). Organizations are expected to be more flexible in facing market changes, especially in IT companies as a fast-growing industry (Wantini et al., 2022; Ibrahim & Ali, 2023; Jodi & Hapzi, 2023; Lindström et al., 2023). By implementing and utilizing advanced technologies organizations enhance their competitiveness (Agustian et al., 2023; Diamantidis & Chatzoglou, 2019; Siddiqui & Zamir, 2018; Kumari & Vangapandu, 2021; Parry & Battista, 2019; Sinha & Sengupta, 2020; Kum et al., 2014; Chowdhury et al. 2022; Batool et al., 2021; Wright & Geroy, 2001). Numerous researchers confirm that training and development programs are crucial for workforce upskilling (Chetana & Noronha, 2023; Siddiqui & Sahar, 2019; Howaldt et al., 2017; Stentoft & Rajkumar, 2020; Ahmad et al. 2020; Demeter et al., 2020). Through

the training process, employees acquire specific knowledge and enhance their abilities, as a key prerequisite for further improvement of organizational performance and competitiveness (Ghobakhloo et al., 2021; Dalenogare et al., 2018; Perifanis & Kitsios, 2023; Gope et al., 2018; Maity, 2019). Especially, the adoption of personalized learning approaches, as a new paradigm, has a significant meaning and is strongly prioritized (Stanojeska, 2024; Pane et al., 2015; Maghsudi et al., 2021). As a consequence of the previously noted arguments, it is more than clear that individual training programs should be designed for each employee's needs according to their level of knowledge and experience (Kraft & Blazar, 2018; Jeni & Al-Amin, 2021). According to Crane et al. (2022), an emergent group of information systems combines AI techniques such as machine learning with behavioral analytics to play the role of a coach or co-regulator, supporting users in self-improvement. AI technology can play an important and helpful role by supporting employee actors in performing their tasks better (Lee 2018). Na (2023) argued that applying AI in workplace training has excessive potential. Additionally, the utilization of augmented and virtual reality technologies can enable the simulation of different scenarios regarding specific working tasks performed (Farrell, 2018; Sorko & Brunnhofer, 2019). Notably, many researchers underline the affordances and importance of using those technologies as a support within the training process.

Despite the above issues, considering the Six Sigma features, as well as numerous scholars' research, this approach can serve as a platform for the efficient structuring of the training and development programs (Erdil et al., 2018). The application of Six Sigma creates a significant impact on culture and human resource practices, such as training (Sony & Mekoth, 2019; Ahmed et al. 2018). Six Sigma deployment encourages employees to shape their skills, and at the same time provide work support (Singh & Rath, 2019; Agbaeze et al. 2019). However, a layered training approach (Define-Measure-Analyze-Improve-Control) has vast benefits and it is ideal since it ensures that the training targets specific needs, groups, and the right people at the right time (Alhosani & Tariq, 2020; Gijo & Antony, 2019). According to Laureani & Antony (2018), the application of Six Sigma is an inspiring drive for employees in an organization.

In this context, it is expected that the DMAIC cycle can be used as a base for the determination of proper methodological steps towards the development of training programs tailored according to the employees' learning background and their professional experience.

3. RESEARCH METHODOLOGY

The two main challenges that this research is faced with are (i) design of the iconceptual model for tailored training programs based on the DMAIC methodology and (ii) validation of the created model by conducting interviews with IT industry professionals.

For the purpose of the first challenge, a comprehensive literature review is conducted. Thus, the model presented in the paper titled “Personalized Training or Successful Implementation of Advanced Technologies in the IT Industry” (Stanojeska, 2024), is upgraded and extended including the DMAIC approach in the development of personalized training programs.

In terms of the second challenge, a survey by face-to-face interview is performed. The survey is focused on the Macedonian IT sector. Actually, five professionals employed in different positions from different IT companies were interviewed during four weeks in October 2024. Both respondents, marked as A and B are owners and CEOs of Macedonian small-sized IT organizations. Respondent C is the Head of a division in an international medium-sized IT company, respondent D is a Senior programmer in a global large-sized IT company, and the last respondent (E) works in a Junior programmer position in an international IT company. Respondents D and E are engaged in large-sized companies. During the survey, the created model was analyzed, discussed, and evaluated according to five criteria, (1) clarity, (2) acceptability, (3) functionality, (4) applicability, and (5) limitations. The gathered data were used for assessment of the created model's potential and sustainability. Thus, the implications of the research presented in this paper are outlined through two primary goals:

G1: Design of the conceptual model for personalized training of employees in the IT industry.

G2: Validation of the created model by the IT professionals.

4. DESIGN OF THE CONCEPTUAL MODEL

As it was aforementioned, research in the paper “Personalized Training or Successful Implementation of Advanced Technologies in the IT Industry” by Stanojeska (2024), includes the conceptual model for employee empowerment where personalization and customization are considered the main drivers in the efficient training of employees. An implication of the created model is the simple question about the mechanisms by which personalized training programs can be provided. In that direction, the Six Sigma DMAIC framework can bring notable meaning because it can be effectively applied to training employees with AI, VR, and AR support. Such integration modernizes the learning approach and aligns with the principles of continuous improvement integrated into the Six Sigma philosophy. Led by the DMAIC cycle, the methodological steps in structuring the personalized programs for training employees will contain the following actions.

The first step of the DMAIC cycle (Define) should involve setting clear objectives for the upgrade program. In this context, the aim, directions, and expected outcome of training programs, should be precisely specified and shared with the concerned participants in the training. It is worth to underline, that the definition of the scope of the training program, the time frame, and the required resources, such as AI

tools, VR/AR platforms, and trainers, are vital for efficient coaching of employees. Those resources should be planned in detail and provided as well.

The second step of the DMAIC cycle (Measure) includes extensive measurements of the employees' current knowledge level and their experience background. In other words, it is necessary to identify the gap between the current skills level and the needed level of skills. For that purpose, assessments, surveys, tests, interviews, and other applicable forms of examination should be conducted. From this point of view, AI technology support can be more than helpful. Using the potential of artificial intelligence technology, the employees' achievements, results, and outcomes can be tracked and evaluated. In this stage, some performance indicators can be defined, in terms of expected improvements in task performance or reduced errors. The performance indicators for error rates could contribute to a more accurate assessment of employees' skill levels.

The third step of the DMAIC concept, Analyze, involves examining the data collected during the metrics step. Actually, by data processing and in-depth analyses, the identification of gaps due to lack of knowledge will be identified. As an implication, differentiation between the skill levels of employees will occur, as an initial point for the development of training programs tailored to the needs of employees. Based on the prior findings, algorithms and appropriate models can be created containing the employees' strengths and weaknesses. Through the analysis of gathered data, AI algorithms can identify the most effective learning methods for each employee. Thus, the created personalized models can measure employees' performance in real time. To clarify, the identified lack of skills will serve as a major prerequisite for creating personalized and appropriate training programs and, as an outcome, specific learning modules transformed into personalized training programs can be developed.

The next step of the DMAIC cycle is the Improve step. This step involves applying the created training programs tailored to different skill levels and knowledge backgrounds. For greater training efficiency, the features of advanced technologies in IT environments such as VR and AR technologies can be implemented, simply because those technologies allow the simulation of various more or less complex virtual real-business scenarios adapted to the specific needs of employees. For instance, by creating realistic simulations VR technology can assist employees in understanding particular tasks and issues as well initially in a virtual environment and before implementing them in reality. Moreover, due to the AI technology trained employees will be challenged to conduct continuous feedback during training sessions. Furthermore, employees will get an opportunity to cope with and correct failings and mistakes in real-time and at the same time to reinforce training and development.

The last step refers to Control, which includes monitoring the progress and gathering data on the effectiveness of the training programs. AI technology can fit well in this context, again. By tracking

improvements in task performance and ongoing assessments, employees will be enabled to fill the knowledge gap. Hence, different mechanisms can be used (mentoring programs, specialized courses, etc.) and the achievements of the trained employees can be recognized. Thus, a sustainable reward system based on the effort and contributions of employees could be applied. This data-driven approach allows employees to continuously improve training strategies, ensuring they remain effective and aligned with the organization's goals.

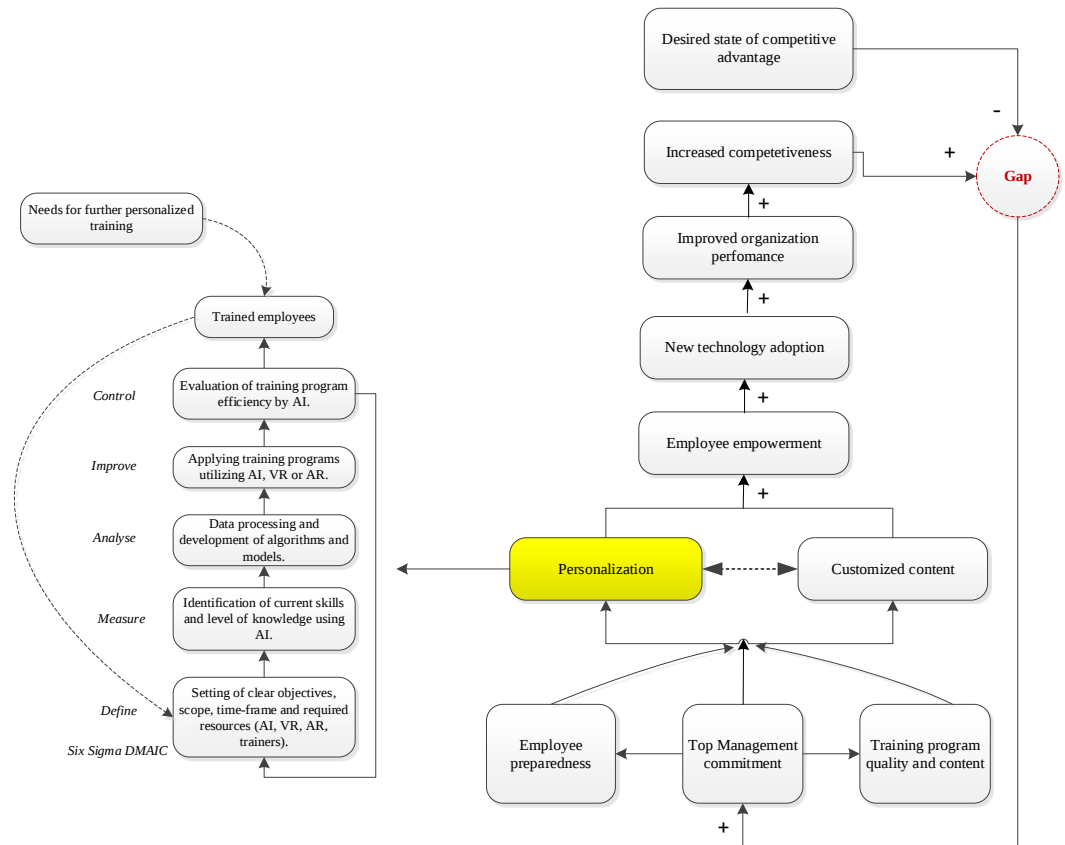


FIGURE 1. CONCEPTUAL MODEL FOR A PERSONALIZED TRAINING PROGRAM BASED ON THE DMAIC STRUCTURAL STEPS
Source: Author's research

The created extension of the conceptual model is presented in Figure 1. Actually, the design of the personalized training and development program follows the five DMAIC structural steps within the Six Sigma philosophy. It is obvious, that the proposed model includes advanced technologies such as AI, VR, and AR to fulfill defined objectives. By evaluating the training efficiency, the employees will be equipped with the expected knowledge and skills. Opposite to the traditional one-type of training intended for all concerned employees, the personalized approach enhances the training effectiveness. Hence, regarding the increasingly changing business dynamic environment, when a new need for the next training appears, the already trained employees will participate in the next training cycle structured to fulfill the new requirements. The designed model promotes the continuous loop of acquiring knowledge following the

DMAIC steps. This data-driven approach enables the creation of personalized training programs customized to the employees' skills gap. Except for AI, VR, and AR, the inclusion of other digital technologies during the performing process is not excluded because any technology that can fit well with the type and nature of the training content can serve as a helpful tool.

From this point of view, the first goal of this research, designing the conceptual model for personalized training of employees in the IT industry, is fulfilled.

4.1 Model validation and potential assessment

The designed model frame is validated in interviews with IT industry experts. Five professionals employed in different positions from different IT companies were interviewed, as previously mentioned. Both respondents, marked as A and B are owners and CEOs of Macedonian small-sized IT organizations, respondent C is the Head of a division in an international IT company, respondent D is a Senior programmer in a global IT company, and the last respondent (E) works in a Junior programmer position in an international IT company. According to following criteria, (1) clarity, (2) acceptability, (3) functionality, (4) applicability, and (5) limitations, the created model was analyzed, discussed, and evaluated.

Throughout the face-to-face survey, the information was solicited directly from the respondents in personal interviews. The questions were sequentially asked and the topics were explained in detail. According to the respondents, the created model is sufficiently explicit and clear. Discussing the second criterion, all respondents confirmed the potential of full acceptability of the presented model in the operation, emphasizing its alignment with current organizational practices and operational goals. Moreover, the same statement was derived in terms of the third criterion – functionality of the discussed model, highlighting its ability to meet the intended organizational objectives.

According to the criteria of applicability of the presented model, all interviewed respondents emphasize that the model is designed to help learners enhance their skills not only for current task execution but also for future task performance. By following the DMAIC steps, the level of employees' knowledge can be upgraded continuously. The effort of employees to improve their skills based on the personalized approach is beneficial for the entire operation of IT companies. In addition, both respondents, D and E, highly rated the utilization of innovative technologies like AR and VR, where employees can engage with interactive simulations and realistic scenarios to improve their skills and knowledge in a hands-on manner.

Regarding the fifth aspect, model limitations, the opinions collected from respondents were not consistent, unlike the previously analyzed criteria. Differences were noted in the statements received from two respondents (A and B) who emphasized the financial investments for implementing AI-based platforms for

improving the skills of their employees, including AR/VR, as well as the costs for ongoing maintenance of the training platform, as one of the main limitations.

Respondent C emphasized that the limitation of the model is that the cultural preferences of teams originating from different regions, typical of international IT companies, can appear as an additional challenge. In essence, the harmonization of teams in global companies is not a simple operation. Hence, there may be a need for various adjustments of AI algorithms regarding the needs of different teams, which may require additional resources, both technical and human.

The last respondent stated that the limitation of the model is derived from the ethical perspective. In other words, the application of this model may hurt the self-confidence of employees because their current skills will be assessed, and based on that they would be trained in differently structured training sessions.

In general, all respondents positively assessed the sustainability of the created model framework based on all the criteria mentioned, and explained the potential limitations of the created model. Thus, the second goal of this research is completed as well.

5. CONCLUSION

Personalization is a major driver towards efficient training and development of employees. By following the DMAIC cycle, organizations can utilize AI, VR, and/or AR to create a more valuable, helpful, and data-driven employee training program. AI algorithms can assess an employee's performance and create personalized training plans based on their strengths and weaknesses. As a result, employee development can be more effective, relevant, and successful. This integrated approach to employee training becomes a winning combination that transforms the traditional training concept while aligning with the core principle of continuous improvement, as advocated by Six Sigma. In other words, this innovative approach in reshaping traditional training sessions for employees in IT companies allows customization according to job roles, departments, and learning styles. One can conclude that it is essential to "retool" traditional training programs and tailor them according to the employees' needs and knowledge gaps.

In terms of the identified limitation of the above research, is addressed on the number of interviewed respondents. More participants in the survey could positively contribute to the validation and model assessment. Explicitly, in IT organizations, customized training programs tailored to the employees' gap of knowledge, skills, and experience should be fully integrated with the business operation and it is crucial for achieving both individual and organizational excellence.

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