

UTILIZATION OF STATISTICAL QUALITY CONTROL (SQC) TOOLS IN EVALUATING THE SELF-LEARNING MODULES FOR BASIC EDUCATION

Gil G. Hagutin^{1,2*}, Roger Joey P. Ihong^{1,3}, Michelle C. Lastimoso^{1,4}, Demi Jas P. Naive^{1,5}, Consorcio S. Namoco Jr.¹

¹University of Science and Technology of Southern Philippines, Cagayan de Oro City, Philippines

²Kinawe National High School, Kinawe Libona, Bukidnon, Philippines

³Camaman-an National High School, Upper Camaman-an, Cagayan de Oro City, Philippines ⁴Bobotungan National High School, Bobotungan, Jasaan, Misamis Oriental, Philippines ⁵Lumbo National High School, Lumbo Lagonglong, Misamis Oriental, Philippines

University of Science and Technology of Southern Philippines, Philippines

*Correspondence Tel. +639606273511 email: [*gil.hagutin@deped.gov.ph](mailto:gil.hagutin@deped.gov.ph)

rogerjoey.ihong@deped.gov.ph michelle.lastimoso@deped.gov.ph demijas.naive@deped.gov.ph, consorcio.namoco@ustp.edu.ph

ABSTRACT: *This study aimed to find out the main factors that influence the defects in reproducing self-learning modules in one of the schools in the Division of Bukidnon. The study implemented the histogram to identify the defects of self-learning modules (SLM) used for distance learning. Root causes of the defects were attributed to personnel's technical proficiency, machines over usage, non-conformity of materials, and no standardized printing system as explained using the Ishikawa Diagram. Moreover, this study aims to provide insights into the preparation of the SLM to ensure quality in the production of a blended learning modality.*

Key Words: Self-learning Modules, Self-learning, Root Cause Analysis, Histogram, Statistical Tool

1. INTRODUCTION

In the milieu of the current pandemic, it can be recalled that in the early part of June 2020, the UNESCO, UNICEF, WFP, and World Bank issued guidelines for the safe reopening of schools despite the worldwide pandemic threat. The guidelines offer practical options for the national and local authorities in responding to COVID 19 and educational strategies for marginalized youth. In response to these guidelines, DepEd Order No.12 series of 2020 established the Learning Continuity Plan (LCP) for the school year 2020-2021 instituting the new learning modalities at all levels. Many public-school teachers had expressed their thoughts, feelings, and opinions regarding the schools' readiness in cascading varied learning modalities in pursuing education in different set-ups. DepEd Secretary Leonor Briones stated that "Education cannot wait" and to ensure the continuity of quality education even during this time of pandemic period, Modular Distance Learning will be implemented making education continue in any situation [1]. The results of DEPED's Learners Enrolment and Survey Form, modular learning was the most preferred modality by parents for their children. This modality can be in a form of printed or digitized self-learning modules (SLM). The SLMs and the other alternative learning delivery modalities were in place to address the needs, situations, and resources of each learner to have access to basic education amidst the challenges posed by COVID-19 [2]. The integration of the SLMs was to ensure the continuity of quality basic education for SY 2020-2021 in the Philippines. The SLMs were delivered in printed format for schools without access to the internet and electricity in the far-flung provinces and communities of the country and those households that have internet connections can access them online or offline [3]. However, initial findings as to the implementation of these learning materials for the SY 2020-2021 created worries and uncertainties on the part of the parents,

students, and teachers in the Philippines. The modules called by DepEd Secretary Leonor Briones the 'backbone' of distance learning were noted to have errors [4]. Lack of funds for module productions also arises as one of the challenges in the implementation of the SLMs [5]. Thus, better learning materials and services are needed to improve education quality, efficacy, and productivity. Therefore, this study aimed to determine the main factors that influence the defects in reproducing self-learning modules utilizing a statistical quality control (SQC) tool and root cause analysis (RCA). This was conducted in a school located in Libona Bukidnon which independently printed its SLM using the online SLM format provided by the Division Office.

2. METHODS

This study was a mixed method design. The instruments for the quantitative data were from the questionnaires for evaluation of printed resource materials adopted from the DEPED Order No. 001, series 2021 [5], while the qualitative portion employs Moustakas' phenomenological principles. The results of the descriptive analysis were used to support the qualitative data.

This study uses a histogram to evaluate the common defects of the printed self-learning modules (SLM) by plotting the frequency distribution of these defects. The data were gathered using the evaluation checklist for the printed self-learning module adopted from DEPED Order No. 001, series 2021. These include the physical attributes, page elements, format, and visuals. Each of these categories consists of an individual key evaluation area (KEA) representing the required quality for an SLM. The basic goals of the qualitative part were to seek reality from teachers' narratives of their experiences and feelings and to generate in-depth descriptions of the phenomenon [6]; of the self-learning module production. A focused group discussion (FGD) was also implemented to initially gather phenomena relevant to the factors that affect the

quality of the printed self-learning modules. “A phenomenon that has something to say to us” [7] about how the SLM production was affected by several factors of quality.

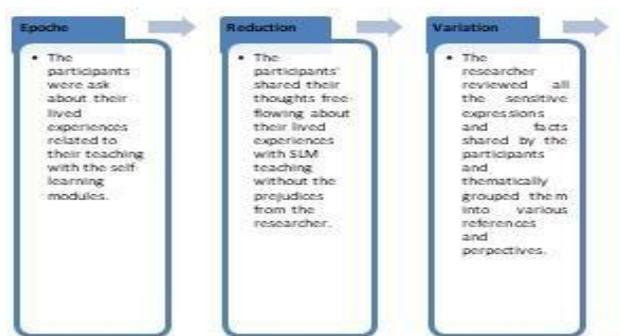


Figure 1 Process flow of the FGD

The qualitative data that was used to feed into the fishbone analysis came from the input of 5 subject teachers and 5 module writers. The formulation of the Ishikawa diagram was separated into two stages: phase I Preliminary Study and phase II Model Development. The descriptive qualitative method was used in the preliminary phase. The qualitative study began with a literature review, which was followed by a focused group discussion (FGD) on the field including the teacher writer and topic teachers, which was utilized as a reference for improving the quality of SLM. The preliminary phase concludes with a description of the SLM and fishbone analysis quality as findings (Factual Model). The second phase involved the creation of the Hypothetic Model as a foundation for the quality of printed self-learning module development.

The sample participants of this study were ten purposefully selected teachers from a secondary high school in Libona. [8] Mason stated that a sample of six would be sufficient to develop meaning for themes and interpretations for a study with a high level of homogeneity. [9] Maxwell stated as a sample that is systematically selected with typical homogeneity will provide adequate representation of the total population and confidence of the conclusions. Purposive sampling can provide important information from the representative of selected settings, groups of persons or events that cannot be taken from other choices.

Data gathering

The first hand was the gathering of the quantitative data to support the first objective of this study. The data were gathered through a checklist questionnaire. The researchers use a checklist tool to assess study quality as an inclusion criterion in systematic reviews and meta-analyses, as well as to test the effects of study quality on effects in these analyses using sub-group and sensitivity analyses [10]. In the context of this study, the checklist questionnaire was adopted from the issuance of DEPED Order No. 001, series 2021 on the evaluation of printed self-learning modules. Checklists can help to avoid procedural errors and miscommunications by optimizing processes [11]. The use of face-to-face interviews in this

phenomenological approach was to capture the real essence of the shared lived experiences of the teachers reproducing the self-learning modules. Face-to-face was employed in this study to restrict nonresponse from the participants and to maximize the collection of quality data [12]. All instances in the interview were digitally audio recorded to precisely capture all language and voice variations.

Data analysis

The quantitative part of this study was analyzed using the histogram. The histogram is a statistical quality tool that uses frequency distribution for analysis. A frequency distribution is represented graphically by a histogram. In the context of this study, the researchers carefully separated all the four major categories that describe the condition of the SLMs as adopted from the checklist made by the Department of Education Order No. 001, series 2021. Each category was analyzed using the histogram to identify which of the KEAs were considered defects in the printed SLM. Meanwhile, the qualitative part of this study uses the Modified Stevick–Colaizzi–Keen method of analysis Moustakas as cited by [13] Frizzell to analyze the data of this study. Some of the processes were modified by the authors to fit the purpose of this research. At the researcher’s epoche stage, the researchers set aside all their prejudices, beliefs, and judgment that could explain the phenomena investigated [14]. The transcendental reduction stage looked at the phenomenon from a different point of view considering all statements with an open mind [15]. In the variation stage, an imaginative intuition to mirror themes relative to the experiences was shared. It was a

stage that was described as a mental experiment about the participant’s experiences, to view the phenomenon from different perspectives [16]. At the synthesis stage, all textual and structural descriptions were combined to form a textual essence of the shared experiences of the participants emphasizing the space and time of the observed phenomenon. This was the stage where the Ishikawa diagram was developed based on the textual and structural descriptions taken from the participants. This stage includes the translation of concepts, exploring and explaining the contradictions, and framing every phenomenon into a whole picture [17].

3. RESULTS AND DISCUSSION

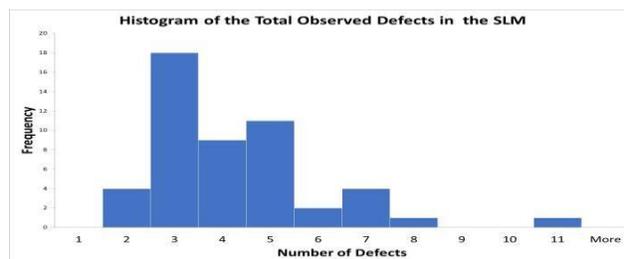


Figure 2 Histogram of the Total Defects in the SLM.

Figure 2 shows the slightly skewed distribution of the total observed defects in the self-learning module. The number of defects found in the sample SLM fall between two to seven counts. The histogram also indicated that out of the fifty modules physically inspected, it was noted

eighteen SLMs were found to contain three defects each. These defects were attributed to the different elements of the four key evaluation areas (KEA) enumerated in the checklist.

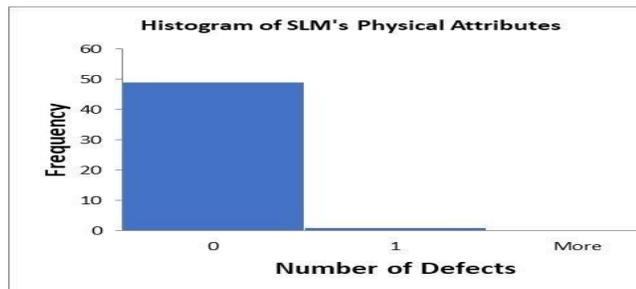


Figure 3 Histogram for Physical Attributes

The frequency of the defects observed generally affects the quality of the SLM. Most of the modules inspected contain errors distributed to the three elements of SLM quality, the page elements, format, and visual contents. Only one learning module contains defects on the physical attributes (Figure 3) specifically on the Grade Level Identifier element.

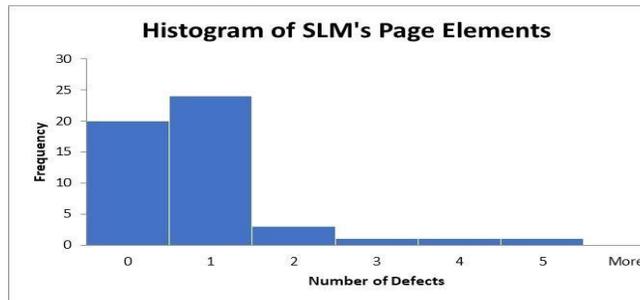


Figure 4 Histogram of SLM's Page Elements

Figure 4 illustrated the frequency distribution of the observed defect of SLM regarding its page elements. It was observed that twenty-four (48%) out of the fifty SLMs have at least one containing the defect. The defects were attributed to the page elements like the Title Page, Copyright page, Introduction Page, Table of Contents, Overview, Presentation, Generalization,

Application, Synthesis, Post Assessment, References, and Answer Key. Twenty (40%) of the SLM observed were found to have no defects and considerably contained all the necessary page elements for a complete SLM as prescribed in the checklist.

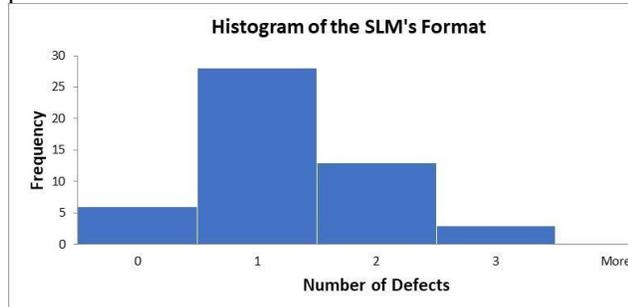


Figure 5 Histogram of the SLM Page Format

Regarding the page format of the self-learning module, Figure.5 shows that twenty-eight (56%) of the observed SLMs contains at least one defect. Another thirteen (26%) were found to have two defects on their page format, three SLM (6%) had three observed defects, and only six (12%) had no defects on the page format as prescribed in the checklist.

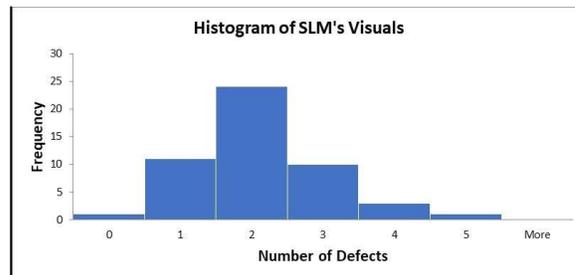


Figure 6 Histogram of the SLM's visual elements

The histogram in Figure 6 indicated that twenty-four (48%) of the SLMs contain two defects in their visual elements. Eleven SLMs contain one defect and ten of them have three defects respectively. These elements include the consistency of the heading styles, appropriateness of the letter size to the target reader, line spacing, and the illustrations being properly balanced inside the page. To determine the main factors that influence the defects found in the printed self-learning module, a root cause analysis was implemented. Table 1 shows the results of the process conducted.

Table 1 FGD Results on the Root Cause of SLM Defects.

Thematic Category	Subcategories	Root Cause
Manpower	Lack of training & orientation	<ul style="list-style-type: none"> Non proficient in bulk printing jobs No basic computer literacy training No technical training on machine maintenance
	Lack of Experienced	<ul style="list-style-type: none"> Teacher printing the SLM is not specializing he subject Teacher selected as writer are not well-equipped with the skills and knowledge required
	Less dedication and commitment	<ul style="list-style-type: none"> Teachers printing the SLM lack of support from the administration
Machines	Over usage	<ul style="list-style-type: none"> Burn out Multitasking Limited number of Risograph Machine
	Defective printers	<ul style="list-style-type: none"> Lack of printing machines Teacher-printer ratio is not equal Printers are not designed for bulk printing
Materials	Sub-standard	<ul style="list-style-type: none"> Ink used are not genuine Non uniformity on paper size and quality
	Un-editable file format	<ul style="list-style-type: none"> Soft copy is pre-formatted and distributed online
Methods	Non colored pages	<ul style="list-style-type: none"> Limited colored ink resources
	Untimely distribution of soft copy for printing	<ul style="list-style-type: none"> No specific date of the SLM soft copy distribution online
	Non-standardized printing system	<ul style="list-style-type: none"> Insufficient time to print and sort the SLM Rapid SLM reproduction

After transcribing the results of the FGD into the fishbone diagram, the researchers came up with four main themes that cause the defects of the printed self-learning modules. These themes were classified as people, machines, materials, and methods. Figure 7 presents the root because analysis results from the FGD in the form of the Ishikawa diagram.

It has been noticed from the root cause analysis (RCA) that manpower comes with the greatest number of causes that contribute to the defects in the SLM. Manpower revolves around the operational and functional labor of people involved in the

processes. This parameter checks whether the personnel's technical proficiency and experience are up to standard [18].

This means that a development program was essential for both the person and the company to gain a competitive edge. A

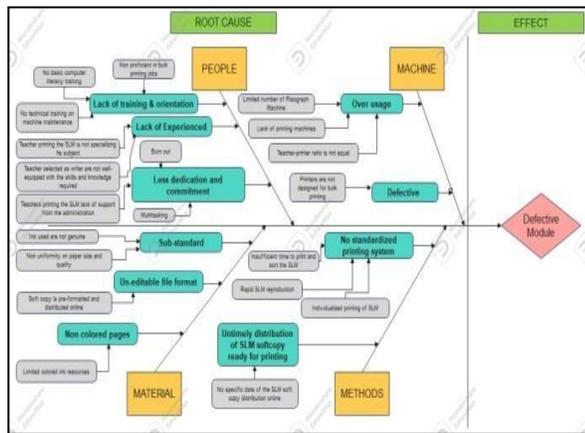


Figure 7 Root Cause Analysis of the SLM Defects

planned and effective development program with supported equipment would greatly aid firms in retaining their most valuable human resources, particularly those with extensive experience with the organization. The mediating role of training in an organization contributes to the improve firm’s performance. There is a link between learning-oriented training and a firm’s performance [19]. This learning-focused training comprises providing employees with intensive, structured, and long-term oriented training, multi-skill, and teamwork. In the study conducted in the Philippines on training interventions for strengthening the technical capability of selected organizations, Opulencia and Dickson et. al. [20] concluded that the adoption of technology and usage of learned skills provided interventions in the socio-economic sector. Strategic communication and skills development would assist firms in terms of empowering and engaging personnel for profitable sustainability [21].

The thematic analysis of our FGD identified machinery in the production of the SLM being overused and defective. The over-usage of this machinery was caused by a limited number of risographs, limited/lack number of printing machines and the printer to user/teacher ratio was mismatched. These were opposite to the claims that machines provide several advantages by automating repetitive or tedious processes, resulting in time and cost savings, and improved decision-making behind what we work on [22]. Individual machinery and equipment must be employed to the greatest extent feasible to ensure the efficient operation of each manufacturing process and job description [23].

Based on the result shown (Figure 7), the defects are also attributed to the materials used. It was found in printed self-learning modules that the components needed to produce the desired result were often mismanaged by utilizing non-uniformity of bond paper sizes and non-colored printed SLMs.

Lastly, the defects found in the SLMs were also rooted

in the methods encountered by the schoolteachers who were lagging on the printing of self-learning modules (SLMs). The causes credited from the two identified problems include the standardized printing system and untimely distribution of SLMs online copies from the Division Office. The former was rooted in having no standardized printing system due to the urgency of SLMs reproduction and the deadlines set for module distribution, and the latter was rooted in having no specified date for distribution of online SLM copies to the schools.

4. RECOMMENDATION AND CONCLUSION

The findings of this study revealed various reasons attributing the defects in the SLM reproduction. Using the RCA, several causes emerged and were classified as people, machines, materials, and methods. If companies can assist all workers in satisfying their needs, both individuals and organizations will profit in the

long run [24]. Addressing successful skill-building programs for firms will provide a competitive edge in tackling globalization problems and achieving sustainable human development. Machines also came out to be one of the causes of the defects in the self-learning module. Another major consideration arose was rooted in the materials and the people behind the reproduction of the SLMs.

Based on the findings of the study, the authors recommend further investigation of the quality of reproduction of the SLM in public schools. The outcomes of this study do not intend to degrade the quality of the SLMs produced by the Department of Education or by the school where this study was conducted. The authors acknowledge the homogeneity of the ethnicity of the participants thus a different lens in viewing lived experiences of the teachers with SLMs in different demographic ethnicity and geographic location is hereby recommended.

ACKNOWLEDGMENT

The researchers would like to extend their heartfelt gratitude to the SLM writers, teachers, and the principal of the school where the study was conducted. This study would not be possible without providing their precious time, support and permission during the conduct of the FGD and evaluation of the SLM.

REFERENCES

[1] DEPED Press Release. Briones welcomes 24.7M learners for SY 2020-2021, declares opening of classes a victory | Department of Education. PRESS RELEASES| Department of Education. <https://www.deped.gov.ph/2020/10/06/briones-welcomes-24-7m-learners-for-sy-2020-2021-declares-opening-of-classes-a-victory/>(2020, September 10).
 [2] DepEd Official Statements. Official Statement on LESF. | Department of Education. Official Statements|Department of Education. <https://www.deped.gov.ph/2020/07/30/official-statement-on-lesf/>(2020, July 29).
 [3] Deped Prepares Self-Learning Modules For Education’s New Normal | Department Of Education.

- (1 July 2020). Retrieved From <https://www.deped.gov.ph/2020/07/02/Deped-Prepares-Self-Learning-Modules-For-Educations-New-Normal/>
- [4] Adonis, M. (2021, April 13). Ph Lags Behind In Acting On Remote Learning Problems Amid Pandemic Inquirer News. Inquirer.Net. Retrieved from <https://newsinfo.inquirer.net/1418185/Ph-Lags-Behind-In-Acting-On-Remote-Learning-Problems-Amid-Pandemic>
- [5] Deped Order No. 001 s. 2021 (2021) Guidelines on the Evaluation of Self-Learning Modules for Quarters 3 And 4 For School Year 2020-2021. Department of Education. Retrieved 6/11/2022 from https://authdocs.deped.gov.ph/deped-order/do_s2021_001-guidelines-on-the-evaluation-of-self-learning-modules-for-quarters-3-and-4-for-school-year-2020-2021/
- [6] Ortamlarında, E., Çalışmaları, F., İçin, Y., Çerçevesel, T., Ve Prosedürler, Y., Yüksel, P., & Yıldırım, S. (2015). Theoretical Frameworks, Methods, and Procedures for Conducting Phenomenological Studies in Educational Settings. In *Turkish Online Journal of Qualitative Inquiry* (Vol. 6).
- [7] Groenewald, T. (2004). A Phenomenological Research Design Illustrated. *International Journal of Qualitative Methods*, 3(1), 42–55. <https://doi.org/10.1177/160940690400300104>
- [8] Mason, M. (2010). View of Sample Size and Saturation in PhD Studies Using Qualitative Interviews | Forum Qualitative Sozialforschung / Forum: Qualitative Social Research. 11(3). Retrieved from <https://www.qualitative-research.net/vol-11-no-3-2010-01>
- [9] Maxwell, J. A. (2008). Designing A Qualitative Study. In *The Sage Handbook of Applied Social Research Methods* (Pp. 214–253). <https://doi.org/10.4135/9781483348858>
- [10] Protogerou, C., & Hagger, M. S. (2020). A checklist to assess the quality of survey studies in psychology. *Methods in Psychology*.
- [11] Gehlbach, H., & Artino, A. R. (2018). The survey checklist (Manifesto). *Academic Medicine*, 93(3), 360–366. <https://doi.org/10.1097/ACM.0000000000002083>
- [12] Lavrakas, P. J. (2008). *Encyclopedia Of Survey Research Methods* (Vols. 1-0). Thousand Oaks, Ca: Sage Publications, Inc. doi: 10.4135/9781412963947
- [13] Frizzell, D. (2015). The Perceptions and Lived Experiences of Leaders Practicing Mindfulness Meditation: A Phenomenological Investigation. In *Walden Dissertation and Doctoral Studies Collection*. Retrieved from <https://scholarworks.waldenu.edu/cgi/viewcontent.cgi?article=2582&context=dissertations&httpsredir=1&refere r=>
- [14] Eddles-Hirsch, K. (2015). Phenomenology and educational research. *International Journal of Advanced Research*, 3(8), 251–260. Retrieved from <http://www.journalijar.com/article/5631/phenomenology-and-educational-research/>
- [15] Schmitt, R. (1959). Husserl's Transcendental-Phenomenological Reduction. *Philosophy and Phenomenological Research*, 20(2), 238. <https://doi.org/10.2307/2104360>
- [16] Turley, E. L., Monroe, S., & King, N. (2016). Doing it Differently: Engaging Interview Participants with Imaginative Variation. *Indo-Pacific Journal of Phenomenology*, 16(1 & 2), 1–10. Retrieved from <http://www.scielo.org.za/pdf/ipjp/v16n2/04.pdf>
- [17] Page, E., & Thomas, J. (2009). Methods for the synthesis of qualitative research: A critical review. In *BMC Medical Research Methodology* (Vol. 9). <https://doi.org/10.1186/1471-2288-9-59>
- [18] Lynch, A. (2022). Cause & Effect Analysis - 6M. Retrieved from <https://www.edrawsoft.com/6m-method.html>
- [19] Aragón, B., Jiménez Jiménez, D., & Sanz Valle, R. (2014). Training and performance: The mediating role of organizational learning. *BRQ Business Research Quarterly*, 17(3), 161–173. <https://doi.org/10.1016/j.cede.2013.05.003>
- [20] Oplencia, M. J. C., Sergio, R. P., Misajon, M. J., & Dickson, A. C. (2015). Training Interventions in Strengthening Technical Capability of Selected Organizations in the Philippines. *Procedia Economics and Finance*, 23, 1624–1627. <https://doi.org/10.1016/S2212>
- [21] Osborne, S., & Hammoud, M. S. (2017). Effective Employee Engagement in the Workplace. *International Journal of Applied Management and Technology*, 16(1), 50–67. [https://doi.org/10.5590/ijamt.2017.16.1.045671\(15\)00515-8](https://doi.org/10.5590/ijamt.2017.16.1.045671(15)00515-8)
- [22] Fedorko, G., Honus, S., & Badiarová, S. (2017). Analysis of the utilization of machinery in the production process using computer simulation. *MATEC Web of Conferences*, 134. <https://doi.org/10.1051/MATECCONF/201713400012>
- [23] Abou, J. (2020, November 16). How Machines Can Help Your Human Employees Work More Productively From Home. Sutherland. <https://www.sutherlandglobal.com/our-thinking/how-machines-can-help-your-human-employees-work-more-productively-from-home>
- [24] Jehanzeb, K., & Ahmed Bashir, N. (2013). Training and Development Program and its Benefits to Employee and Organization: A Conceptual Study. *European Journal of Business and Management*, 5(2). <https://www.dcvmn.org/IMG/pdf/3947-5999-1-pb.pdf>