

Design and Development Research on the Module to Manage Noise Exposure: A Case Exemplar Anchored on the OSHEMT Framework

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ABSTRACT : *This article elaborates on the module development processes with the analysis of exemplary occupational safety, health, environmental management tools (OSHEMT) practices through andragogical approaches as a new parameter to manage cases of hearing impairment caused by noise exposure. This study focuses on the development of an educational module to manage noise exposure in small and medium manufacturing sectors through a modular approach. It employs a mixed-method research methodology, specifically design and development research processes, and analyses data from case exemplars using the OSHEMT framework. The research employs quantitative and qualitative methods. The module development is based on the analysis, design, development, implementation, and evaluation (ADDIE) framework. The study elaborates on the ADDIE instructional design model, particularly during the analysing and evaluation phase. This phase includes the observation of practices in five selected companies, extracting open-ended responses from surveys, and conducting interviews with employees and employers in the selected industries. The study also elaborates on the seven main and sub-tools anchored upon the OSHEMT framework. These include the OSHEMT policy (OSHEMTTP), budgeting (OSHEMTB), monitoring committee (OSHEMTMC), facility (OSHF), competency (OSHEMTC), transparency (OSHEMT-T), and reporting and communication (OSHEMTRC). The analysis is based on case exemplars, highlighting andragogical approaches to overcome problems relating to noise in manufacturing industries which negatively impacts employee health, with suggestions for future studies. By leveraging andragogy approaches, OSHEMT can enhance the working environment by managing noise exposure and mitigating employee hearing loss. (203 words)*

Keywords : *Andragogical Approach, Design and Development Research (DDR), Environmental Management Tools (OSHEMT) Health, Manufacturing Sectors, Noise Exposure, Occupational Safety, Small and Medium (SMEs)*

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1.0 INTRODUCTION

1.1 Background and Overview

Recognising the critical importance of occupational safety and health (OSH) implementation in the workplace, particularly within the small and medium enterprises (SMEs) of the Melaka industrialised sector, the state of cleanliness and OSH practices in Melaka have come under scrutiny because of a lack of supervisory culture and non-compliance with regulations (Kha et al., 2020). This study aimed to integrate workplace noise exposure measurements into occupational safety, health, and environmental management tools (OSHEMT), developed by the first author, to serve as a guideline for enhancing OSH practices in the workplace.

1.2 Problem Statement and Rationale

There are approximately 415,000 registered companies in Malaysia with over 200,000 employers in the manufacturing sector. In Melaka, one of Malaysia's states, there are approximately 22,000 employers, of which approximately 1,500 operate within small and medium manufacturing industries or small and medium enterprises, interchangeably abbreviated as SMEs in this study.

Collectively, the manufacturing industries employ 1.5 million workers out of the nation's total of 9 million. However, there has been an annual increase of 10,000 permanent incapacities registered, resulting in a loss of approximately 2.5 billion ringgit per year within this sector, with 88% of incidents attributed to "dangerous acts." According to the Economic Census (2016) and the Department of Statistics Malaysia, all employees exposed to hazardous noise levels (above the action threshold of 85 dB) are required to undergo audiometric hearing tests in accordance with the Factories and Machinery Act, 1989.

A significant knowledge and implementation gap exists regarding occupational safety and health (OSH) requirements in Malaysian manufacturing SMEs, contributing to high rates of workplace accidents and injuries (Yeow et al., 2022). Developing a tailored OSH policy for manufacturing SMEs could be beneficial for addressing these issues. The question is whether there have been any efforts or discussions within the industry or government to develop such a policy (Daim, 2021).

Utilising a modular approach within the design and development research (DDR) framework through an andragogical approach is an effective strategy for simultaneously outlining hazardous elements and their consequences. DDR research methods assist researchers in designing studies and innovating various instrument forms according to the phases involved (Pang et al., 2020; Richey and Klein, 2014).

The DDR process was implemented in the Bukit Rambai Industrial Zone for SMEs, where wood and furniture industries predominate. Based on the objectives of this study, this highly developed industrial zone with high-capacity plants was deemed suitable for determining industrial noise-induced hearing loss.

1.3 Aims, Research Objectives and Research Questions

This study is part of a large-scale investigation focusing on the challenges faced by SMEs in Melaka concerning the promotion of OSH. Non-compliance with regulations such as the OSH Act 1994 and the Factories and Machinery Act 1967 (revised in 1974) potentially contributes to these challenges, impeding SMEs' productivity. Consequently, this study advocates the utilisation of OSHEMT management through a modular approach to increase the awareness of noise exposure.

The primary objective of this study was to underscore the necessity of noise-level measurement techniques in industrial settings, with the ultimate goal of mitigating noise exposure within SMEs to prevent hearing impairment. Simultaneously, it sought to educate employers on the importance of maintaining clean and noise-free environments. Such an approach stands to benefit all stakeholders, including the Melaka State Government and SMEs.

Table 1 indicates that in 2022, there was an increase in the number of manufacturing SMEs reporting permanent disabilities, with only one of these cases attributed to an occupational health issue. Most disability cases involved the hands and fingers, highlighting the necessity for guidance and tools to enhance OSH practices in manufacturing SMEs. OSHEMT has emerged as an optimal guidance and tool for such practices.

Table 1: Melaka Manufacturing SMEs Accidents (Permanent Disabilities) 2022

No	Company	Sector	Date of accident	Remark
1	Bradken Casting (M) Sdn.Bhd	Manufacturing (SME)	26/02/2022	Left finger was broken by a wood-cutting machine
2	Lum Mah Plastic and Printing (M) Sdn.Bhd	Manufacturing (SME)	26/04/2022	Broken hands and crushed thumbs caused by a roller machine
3	Meiden Metal Engineering Sdn.Bhd	Manufacturing (SME)	11/03/2022	Hearing impairment (loss of hearing)
4	Olympic Cable Company Sdn.Bhd	Manufacturing (SME)	29/06/2022 and 07/08/2022	Broken finger caused by wire-making machine
5	Shantawood Mfg.Sdn.Bhd	Manufacturing (SME)	05/02/2022	Left thumb was broken by a wood chipper
6	GHS Food Industries Sdn.Bhd	Manufacturing (SME)	16/12/2022	Small finger was broken by the production machine

Table 1 indicates that in 2022, there was an increase in the number of manufacturing SMEs reporting permanent disabilities, with only one of these cases attributed to an occupational health issue. The majority of disability cases involved hands and fingers, highlighting the necessity for guidance and tools to enhance OSH practices within manufacturing SMEs. OSHEMT emerges as the optimal guidance and tool for such practices.

The primary objective of this research was to develop management tools, specifically OSHEMT, utilising an andragogical approach with module development anchored on the analysis, design, development, implementation, and evaluation (ADDIE) framework to address noise exposure in the workplace. The research objectives of this study were as follows:

- 1. To propose OSHEMT anchored on a modular approach to manage the noise in SMEs.**
- 2. To illustrate the DDR processes of the ADDIE module using an andragogical approach for managing noise exposure in SMEs.**

Based on the aforementioned research objectives, the following research questions (RQs) were identified:

- (1) How can the OSHEMT framework, anchored in a modular approach, manage noise exposure in SMEs?**
- (2) What DDR processes are involved in developing the ADDIE module for managing noise exposure in SMEs?**

2.0 METHODOLOGY

2.1 Research Framework and Sampling Techniques

The research framework for this study was a mixed research method (Creswell, 2009) which involved DDR, observation, interviews, surveys, and case studies with mixed-mode data analysis (Johnson & Onwuegbuzie, 2004 as quoted by Ng et al., 2020). The study involved healthy respondents between the ages of 20 and 55 years who had worked for at least three years in noisy environments, as recommended by noise monitoring programs.

Sampling technique and pilot study - A case study is an in-depth examination of a subject's natural environment (Yin, 2018), such as an individual, group, location, event, organisation, or phenomenon. The term "case" can refer to an individual (for example, a manager), a group (for example, a work team), an organisation (for example, a business), an association (for example, a joint venture), a change process (for example, restructuring a company), or an event (for example, an annual general meeting). According to McCombes (2019), case studies effectively describe, contrast, evaluate, and comprehend the various facets of a research problem.

A total of 55 respondents were tested based on their work demographics, with the main objective of collecting consistent and reliable information about their working conditions as assessed by their employers. The assessment covered social, demographic, work duration, and work type aspects. The study found that the level of noise control management in the company was moderate; however, there was room for improvement to achieve better OSH and environmental management. For this purpose, organisations need at least one person competent in noise risk assessment (NRA) and DDR by ADDIE to create awareness among employees towards noise management in the workplace.

Employers must also ensure that awareness training is mandated for all employees through OSHEMT and that the seven tools are implemented. The study also examined the OSH management practices of various SMEs operating in Melaka, including Le Hu Feedmill (M) Sdn. Bhd and its four subsidiaries: (a) Le Hu Feedmill (M) Sdn. Bhd (aqua plant), JC Nutrimix (M) Sdn. Bhd, and Bea Agrotech (M) Sdn. Bhd (all located in the Bukit Rambai industrialised district); and (b) Id Multifeed (M) Sdn. Bhd from the Tangga Batu industrialised district.

For the purposes of this research, the case study method was deemed the most appropriate method for addressing the three RQs. It was determined that SMEs in the animal feed manufacturing sector in Bukit Rambai, Melaka, were suitable for a case study.

The selected SMEs produced animal feed and employed between 50 and 150 employees each. The animal feed manufacturing sector in Melaka, especially in the Bukit Rambai Industrial Area, was expected to play a significant role in the state's economy in 2021. It has bolstered the agricultural and food industries, generated employment opportunities, and attracted investment in the region. The sampling framework for this research comprises a list of all SMEs in the Melaka manufacturing sector registered with the Department of Occupational Safety Health (DOSH).

The sampling methods were based on the company's audiometric test reports conducted by a noise contractor according to the OSH Noise Regulations, 2019. Factors such as participant exposure to noisy work areas, duration of employment, and age were the primary considerations for the audiometric test. Furthermore, the internal and external noise risk assessment results were included in the data analysis, encompassing 27.5% of the total employees of the companies participating in this research. This comprehensive approach facilitated the acquisition of better results by drawing on work environment, DOSH information, OSHE WhatsApp groups, and company staff details.

2.2 Respondents Involved in Data Collection and Analysis

Le Hu Feedmill Sdn. Bhd is an animal feed manufacturing company located in Bukit Rambai that has operated for over 15 years. The company employs 200 employees, including foreign workers from Nepal, Bangladesh, and Myanmar.

Operating as a single manufacturing unit that runs 24 hours a day, the Le Hu Feedmill stands out among other businesses in the area, which typically operate for approximately 16 hours. However, similar noise generation issues have arisen in neighbouring firms because of a lack of knowledge and skills in OSH management.

The respondents for this study were from the industrialised areas of Bukit Rambai and Tangga Batu, where local animal feed is produced. The primary aim of this study was to advocate for a better approach to enhance compliance with regulations and provide advice to DOSH officials based on the research objectives. These refined regulations will subsequently be enforced, offering these organisations significant potential to enhance their OSH practices and the quality of their surroundings. Our findings can be translated into guidelines that can raise awareness and upgrade their OSH management systems.

3.0 ANALYSIS AND DISCUSSIONS

3.1 The Management of Noise Exposure using the OSHEMT Framework Anchored on a Modular Approach (RQ1)

In response to RQ1, a study was conducted involving five businesses as participating companies. The analysis revealed that Le Hu Feedmill (aqua) had the highest percentage of failures in the audiometric test (total fail manpower 12 / total test manpower 14 × 100 = 85.71%), followed by Bea Agrotech (83.33%) and Id Multifeed (70%). Hearing loss in the right ear was highest at JC Nutrimix with (hearing impairment right ear 3 / total fail manpower 6 × 100 = 50%), followed by Le Hu Feedmill and Id Multifeed at 42.86%. Hearing loss in the left ear was highest at Le Hu Feedmill (aqua) with (hearing impairment left ear 4 persons / total fail manpower 12 persons = 33.33%), followed by Bea Agro trade and JC Nutrimix at 20% and 16.67%, respectively.

The analysis of data on hearing loss affecting both ears showed that Le Hu Feedmill (hearing impairment both ears 4 persons / total fail manpower 7 persons × 100 = 57.14%) and Id MultiFeed were contributors at 42.86%, followed by JC Nutrimix with Le Hu Feedmill (Aqua) at 33.33%. The study also showed that individuals with six to ten years of service at Le Hu Feedmill Sdn. Bhd had the highest failure rate (years of service 5 persons / total fail manpower 7 persons × 100 = 71.43%), with Le Hu Feedmill (aqua) and JC Nutrimix being the highest contributors at 66.67%, followed by Bea Agrotech at 60%. Refer to Table 2 and Figs. (b) and (c) for more detailed information.

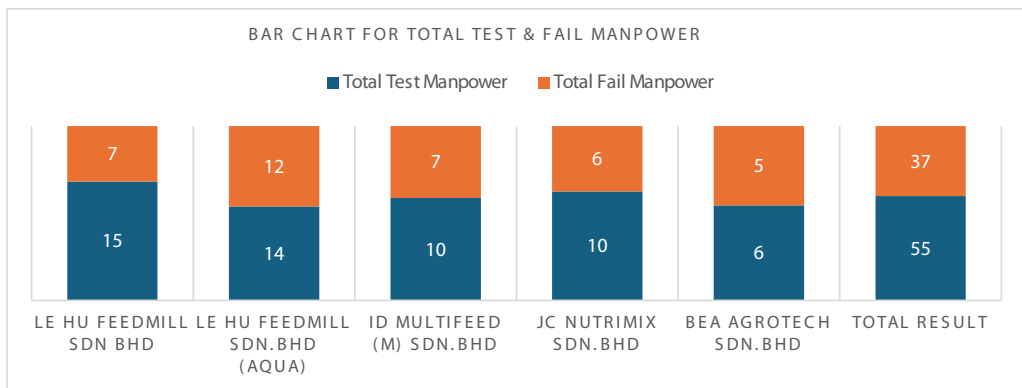


Figure (a): Total Audiometric Test and Fail Manpower

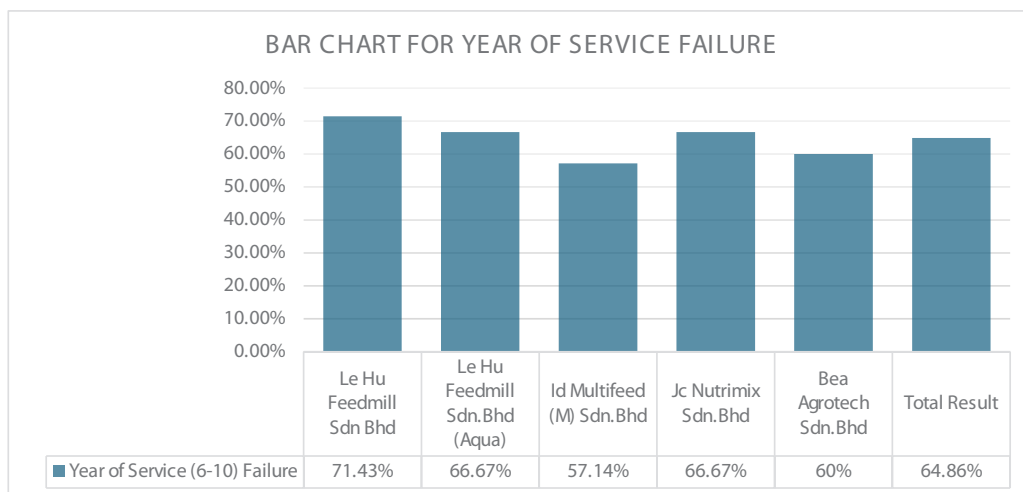


Figure (b): Year of Service Failure

Table 2 Audiometric Analysis Result on Five Small and Medium Company at Bukit Rambai Industrial Area

Study Item	Le Hu Feedmill Sdn Bhd	Le Hu Feedmill Sdn.Bhd (Aqua)	Id Multifeed (M) Sdn.Bhd	Jc Nutrimix Sdn.Bhd	Bea Agrotech Sdn.Bhd	Total Result
Total Test Manpower	15	14	10	10	6	55
Total Fail Manpower	7	12	7	6	5	37
Total Fail%	47%	85.71%	70%	60%	83.33%	67.27%
Year Of Service (6-10) Fail	5 = 71.43%	8 = 66.67%	4 = 57.14%	4 = 66.67%	3 = 60%	24 = 64.86%
Hearing Impairment Both Ears	4 = 57.14%	4 = 33.33%	3 = 42.86%	2 = 33.33%	2 = 40%	15 = 40.54%
Hearing Impairment Right Ear	3 = 42.86%	4 = 33.33%	3 = 42.86%	3 = 50%	2 = 40%	15 = 40.54%
Hearing Impairment Left Ear	NIL	4 = 33.33%	1 = 14.28%	1 = 16.67%	1 = 20%	7 = 18.92%

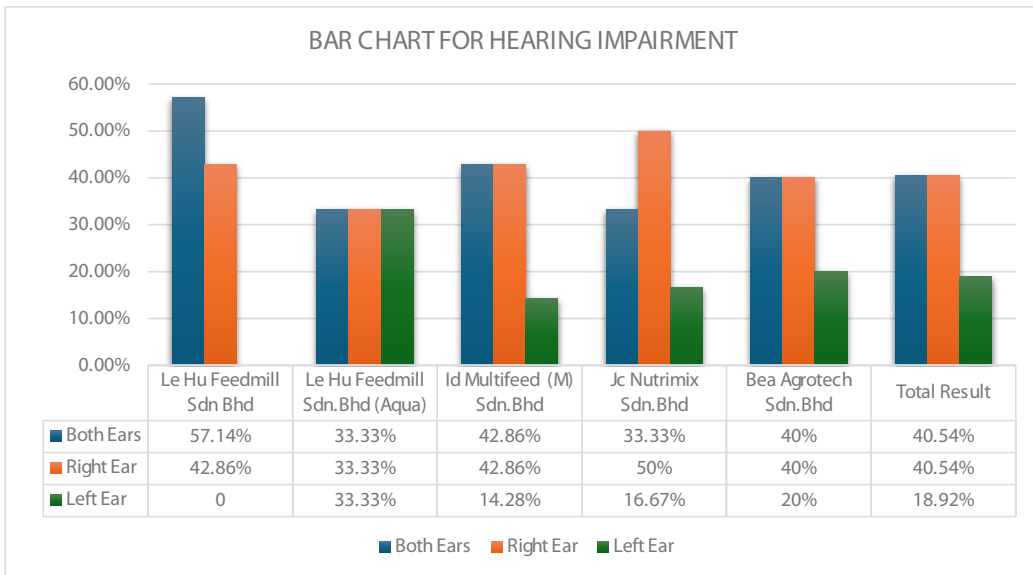


Figure (c): Hearing Impairment

The necessity of OSHEMT for managing noise exposure is of paramount importance. The researchers recommend that companies conduct awareness campaigns to educate their employees about the prevention of long-term hearing loss. Employers should also analyse the ergonomic aspect to prevent recurring problems, as it is a major concern for employees who may not be able to work in a noisy environment for more than four hours at a time. In noisy workplaces, job rotation for various personnel is required based on a predetermined amount of time.

Managements should also conduct engineering studies to eliminate actual sources of noise, such as machinery, by investing in more advanced technologies to reduce workplace noise pollution. While employers may provide earplugs capable of covering noise of up to 105 decibels, if noise exposure exceeds 135 decibels, employees remain exposed to 30 decibels of noise at work. Continuous exposure can lead to hearing loss over time. To mitigate this problem, noise sensors and warning alarms should be installed, activating whenever noise levels exceed a certain threshold; ultimately, the power to the units producing excessive noise should be switched off. The licencing authority should oversee the entire process to ensure compliance.

The commitment of top management is crucial for implementing actions related to company safety, environmental policies, and OSH. Without their dedication, all efforts are likely to fail. It is imperative to adhere to directives such as amendments to regulations such as the Environment Clean Air 2004 to 2014 and Noise Regulation 2019. Organisations must practice OSHEMT to manage noise exposure comprehensively, including policies, budgeting, competency, facilities, internal and external communications, and OSH environment committees.

Manufacturing SMEs must assess their occupational safety and pollution control through human resource management and development, including policies, procedures, training, education, motivation, rewards, internal committees, internal and external audits, OSH, and environmental promotion. This entails noise conservation training, NRAs, and ergonomic risk assessment. All educational and training processes should be integrated into ADDIE or andragogical processes to develop competency in the workplace. This approach enhances employee motivation to achieve safety, health, environmental, and productivity goals in the work area.

Psychosomatic or intrinsic rewards such as respect and gratitude play a crucial role in encouraging workers and improving their performance. Therefore, to empower an organisation, the person in charge must also be empowered to fulfil their duties. Genuine appreciation and recognition are inherent benefits that motivate and enhance performance. As part of the

motivation concept, intrinsic motivation should be fostered, which in this study refers to employees performing tasks themselves and practising OSHEMT to sustain OSH management (Abdullah et al., 2016).

Module Development for OSHEMT.

Figure 1 illustrates OSHEMT, which comprises seven components for monitoring industrial workplace compliance with OSH environmental standards. These tools are connected with OSH practices that enhance the OSH environment. For instance, clean production (CP) promotes good health and a healthy environment, while a safe environment fosters productivity and efficiency.

Safe and clean practices, such as proper waste schedule management, can facilitate reuse through recycling, storage, and inventory management, aided by an electronic schedule waste inventory system. A safe workplace ensures healthy working conditions and encourages employees to perform optimally. CP and a secure environment are recognised as the preferred methods for achieving efficient resource utilisation, protection, and effluent avoidance. The OSHEMT module is crucial for managing noise exposure in manufacturing SMEs.

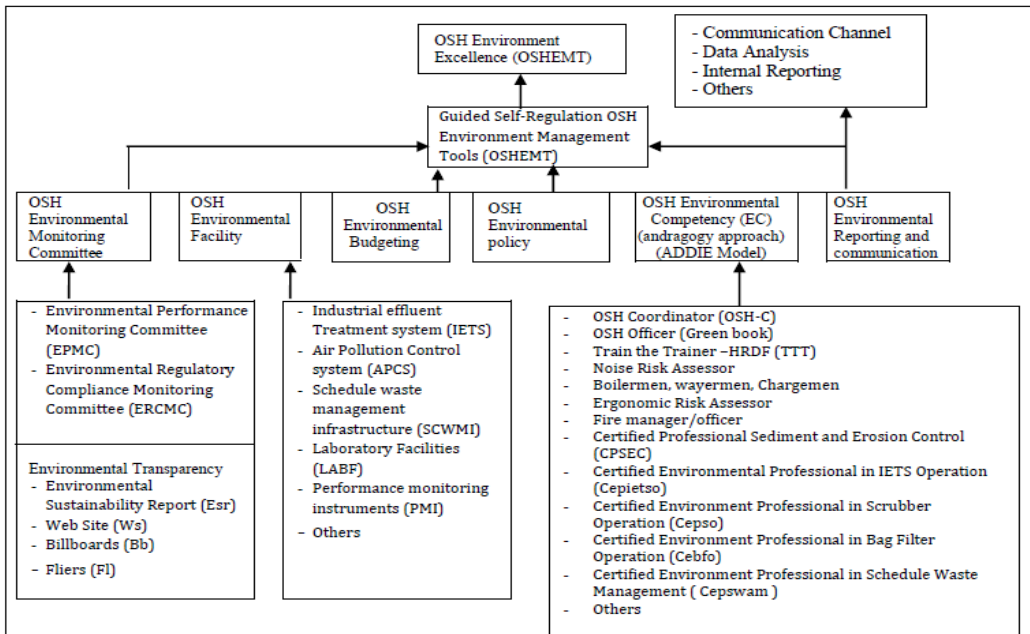


Figure 1: OSHEMT Main and Sub Tools

The above sub-tools underscore the importance of manufacturing units being cognisant of them as they serve as the primary means of achieving compliance with regulations. For instance, they should ensure the training of a certified OSH coordinator (OSH-C) to effectively manage OSH matters, and consider providing training or appointing an assessor for NRAs in the workplace. Employers should recognise the significance of having an individual certified in Train-the-Trainer (TTT) programmes to oversee internal training initiatives.

Moreover, there should be a focus on prioritising the training of more certified individuals within the workplace to enhance motivation and improve employees’ skills and knowledge through andragogy and an understanding of the ADDIE framework. Employers may also opt to hire competent personnel, such as a certified person in schedule waste management (CEPSWAM) and an OSH-C with TTT qualifications to manage the OSHEMT noise environment in the workplace.

3.2 The DDR processes in the development of ADDIE module to manage noise exposure in the SME (RQ2)

In response to RQ2, a module was developed utilising the ADDIE model. This instructional design paradigm facilitates the organisation and streamlining of course material creation through five stages, which encompass the DDR process.

The term andragogy is synonymous with adult education, referring to any form of adult learning (Kearsley, 2010). The ADDIE model serves as an instructional design methodology aimed at systematising and restructuring towards goal realisation. ADDIE is an acronym for the five stages of progress: analysis, design, development, implementation, and evaluation (Quigley, 2019). These modules are essential for creating a sustainable working environment that motivates both employers and employees regarding noise exposure management in their workplace, as per this research.

As depicted in Figure 2, employers play a crucial role in enhancing employees' skills and knowledge through the andragogical approach and ADDIE model. The initial process, 'Training Needs Analysis' (TNA), which involves analysing the need or objective for the company towards OSHEMT progress, is pivotal. It is imperative to hire or train certified TTT individuals to manage the OSHEMT progress.

Before developing any content or training strategies, the company must analyse the current situation regarding training, information gaps, and so forth and commence with a series of questions to understand the current condition and readiness for the guidance program. The instructor adopts the role of a facilitator, guiding the workforce to familiarity and actively involving participants in knowledge development, rather than merely presenting them with information (Knowles, 1984). In this context, only certified TTTs can execute training strategies through TNA.

The design phase ensues after identifying the type of need in the OSHEMT process. Learning experiences from the previous phase are leveraged to make practical decisions regarding strategy, delivery methods, structure, duration, assessment, and feedback. These decisions involve creating a master plan for courses in prototype form and discussing the value of training with management. This approach aids in designing progress for adult learners who need to build an expanding storehouse of knowledge that evolves into an ever-growing resource for wisdom. Experiential learning, which includes errors, lays the foundation for knowledge activities. For instance, only individuals involved in schedule waste management in the workplace can fully comprehend the necessary requirements.

ADDIE creates skilled and knowledgeable employees. This is an opportunity for working adults to gain more skills to improve their safety and health in the workplace. For example, when more employees are exposed to noise-protection skills and knowledge, the risk of hearing impairment decreases in the long term. The role of a competent person is to monitor and inspect the use of personal protective equipment (PPE) among employees, and continuously educate them through caution points and signage. Competent persons with management commitment must conduct training for concerned employees based on TNA. This will help them achieve their target of producing skilled workers at the right time and place with the right employees.

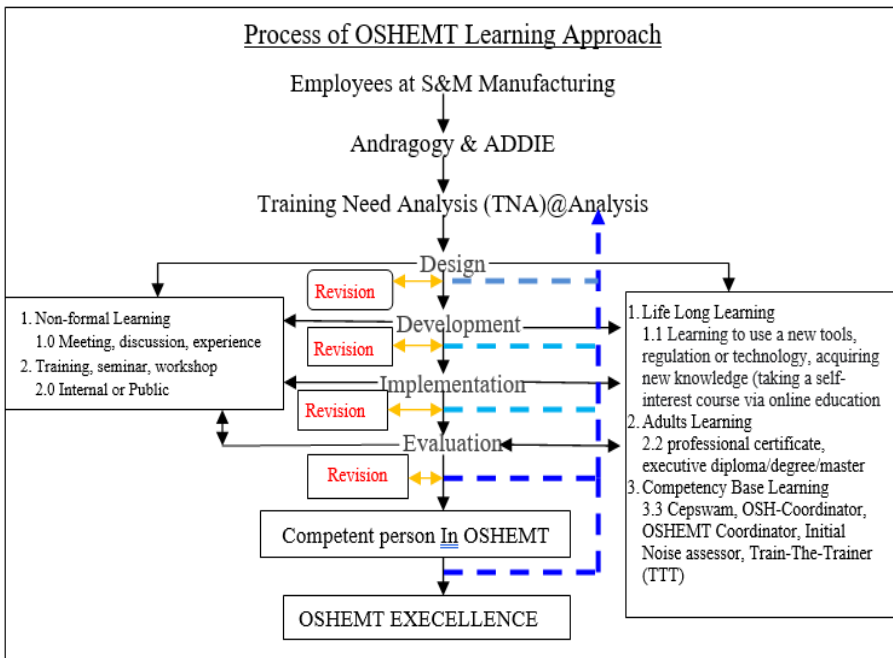


Figure 2: Process of Andragogy and ADDIE for Competency in OSHEMT.

Based on a master plan for the courses in prototype form and after discussions with company management, it becomes a pivotal document used to develop the progress of OSHEMT learning. Every aspect of lesson progression should align with the design chapter, and any requested additions should be prioritised and refined to enhance the course’s appeal. Although seemingly insignificant, this has a substantial impact on the comfort level during the course.

Therefore, the improvement process must be iterative. Once a course has been produced, testing must be performed to ensure that there are no fundamental errors. Test cases should also examine the course procedures. Navigation is a significant concern at this stage. Most of the issues encountered by learners are related to how the course is constructed in the authoring instrument. At this stage, course content that aligns with the design stage in a master plan should be developed to achieve the desired learning outcomes for employees. The Environmental Institute Malaysia has developed course content to facilitate the adult learning process (EIMAS, 2017).

Once the training syllabus is complete and the course content has been thoroughly tested and approved, learners can implement it. Decisions made in the design chapter dictate how this is executed. One of the most effective ways to avoid issues during the implementation stage is to conduct a pilot course before releasing the content to the entire audience. The primary objective of andragogy and ADDIE is to provide a structured approach for developing training packages.

However, it also serves as a powerful framework for optimising the production of subsequent iterations. Receiving feedback on each course segment is crucial for future improvements. A great method for gathering feedback is asking participants to complete surveys at the end of their course. This can be integrated into the course using various analytical methods. Employees should be aware of what is best for their future, and enhancing their skills and knowledge will improve their quality of life and career prospects.

OSHEMT Policy - The OSHEMTP of prosperous companies uses a strong and clear statement to express their commitment to OSHEMT for their human capital, clients, suppliers, and the community. The OSHEMTP is made available to all relevant groups and implemented in the standards of work practices and business decision-making processes, and cascades

down to the supply chain. This policy integrates OSH and environmental policies and requires top management commitment to achieve the organisation's aims and vision in OSHEMT. The policy should be structured as follows:

- **Attracted to the workforce and their advisory council. This is a process of analysing the organisation's vision and goal towards OSHEMT with all parties' involvement.**
- **Stated in clear, unmistakable terms. This is the process of designing a proper policy to bring a clear message from top management towards OSHEMT in the workplace.**
- **Signed by the highest-ranking person in the association. This is a process of policy development in which the top management proves their commitment by signing the policy.**
- **Keep abreast with the latest information. At this stage, top management must always be updated on any information regarding OSHEMT, such as regulation updates, training information, and competency upgrading. The latest regulations should be implemented to conform to these requirements.**
- **OSHEMT achievements are communicated to the workforce, as well as anyone or any team who is interested in or affected by them. This is a process of delivering the company vision and objectives on OSHEMT through an andragogical approach, such as meetings, seminars, training or life-long learning, adult learning, and competency-based learning. The OSHEMTP must be understood by the entire workforce to confirm its achievements.**
- **Adherence to regulations in all works performed. This stage evaluates whether employees adhere to the OSHEMTP. The evaluation or renewal process shall be performed at least once every two years or when necessary.**

OSHEMT Budgeting - An adequate budget must be allocated exclusively to fulfil the OSHEMT regulatory requirements and other OSH-linked initiatives. During the conceptual phase, resources must be made accessible to design and upgrade OSH surveillance capabilities. Throughout the operational phase, resources should be allocated for the effective management and maintenance of OSHEMT control systems as well as for monitoring OSH hazards resulting from company or project expansion in the industry. The OSHEMT also encompasses the costs of upgrading the OSHEMT equipment, providing personnel training, and acquiring standard surveillance or monitoring devices. Budgeting is essential for cultivating more skilled workers through the ADDIE process, as shown in Figure 2.

OSHEMT Monitoring Committee - To foster collaboration and promote OSHEMT compliance, two observation committees should be established and developed: one at the operational level and the other at the regulatory level. At the operational level, the committee is led by a higher administrator of the organisation and consists of the OSHEMT performance evaluation committee which meets monthly or at least once every three months to review the OSHEMT progress towards achieving its goals. At the regulatory level, the committee is known as the OSHEMT regulatory compliance monitoring committee which meets at least once a year and is chaired by the chief executive officer to analyse, design, develop, and evaluate the outcomes.

OSHEMT Facility - The ADDIE model is used for the analysis, design, and development of the OSHF, which includes an industrial treatment system, best management strategies, and support facilities. It also involves an annual audiometric test for affected workers, noise monitoring, and evaluation equipment to ensure technical control limits for workplace noise pollution, an online measurement system, and PPE. A noise reduction training seminar or workshop (using an andragogical approach) is also crucial. These components must not be compromised and must be integral to the company's overall infrastructure planning and development.

OSHEMT Competency - Personnel who play a vital role in discharging various OSH and environmental tasks within a business must possess the necessary skills. Examples include an OSH-C, confined space entry supervisor, and verified OSH instructor. The organisation must analyse, design, and develop a comprehensive curriculum to produce competent individuals and qualified support personnel to ensure complete compliance with DOSH and Department of Environment regulated activities. The types of competent individuals are presented in Table 3.

Table 3 Environmental Competency Status in Melaka

No	Type of Competency	No. of Competency Person in Melaka	Remark (1500 Melaka Small & Medium Manufacturing)
1.	Certified Environmental Professional in Scheduled Waste Management (CEPSWAM)	65(2018) 161 (2021)	65/1500×100= 4.33%(2018 EIMAS data) 161/1500-100=10.73% (22/5/2021 –EIMAS data)
2.	Certified Environmental Professional in Bag Filter Operation (CePBFO)	5	5/1500-100 = 0.33%
3	Certified Environmental Professional in the operation of Industrial Effluent Treatment Systems (Biological Processes – Activated Sludge Process)Cepietso(Bp)	11	11/1500-100= 0.73%
4.	Certified Environmental Professionals in the operation of Industrial Effluent Treatment Systems (Physical-Chemical Processes)Cepietso(Pep)	22	22/1500-100= 1.47%
5.	Certified Environmental Professionals in the treatment of Palm Oil Mill Effluent (Ceppome)	4	4/1500-100 = 0.27%
6.	Certified Environmental Professional in Scrubber Operation (Cepso)	9	9/1500-100 = 0.6%
7.	Certified Environmental Professionals in Sewage Treatment Plant Operation (Cepstpo)	5	5/1500-100 = 0.33%

Data from: www.eimas.doe.gov.my 25/5/2018 & 22/5/2021

Tables 3 and 4 illustrate that promoting the andragogical approach and ADDIE model is timely for the Melaka manufacturing SMEs sector. In 2018, only 4.33% of this sector held the CePSWaM certification, which increased to 10.73% by May 2021. Furthermore, only 30 individuals in this sector possessed an OSH certification, accounting for 4.33% of the workforce. This indicates the industry's need to commit to increasing the number of skilled employees in the workplace through HRD Corp. funding and producing more competent employees, especially in NRA, OSHEMT, CePSWaM, and OSH-C. These statistics were obtained from the Environment Institute of Malaysia and DOSH using the MYkkp system.

Table 4 OSH-C Competency Status in Melaka

No	Type of Competency	No.of Competency Person in Melaka	Remark (1500 Melaka Small & Medium Manufacturing)
1.	Occupational Safety Health Coordinator (OSH-C)	30	30/1500X100= 4.33% (2021 MYkkp data 22/5/2021)

Data from: MYkkp 22/5/2021

OSHEMT Reporting and Communication - This is the process of implementing OSHEMT progress developed by the top management of the organisation through OSHEMTRC instruments. For instance, protocols for reporting accidents or near misses, safety operating procedures, emergency action plans, and team progress must be shared with all employees to obtain better feedback or results. This procedure can be conducted visually, verbally, or electronically through email, phone, WhatsApp, memos, warning signs, meetings, or training. This process is based on an andragogical approach involving the adult learning process. It is important to develop appropriate channels to assess the adequacy of OSHRC components.

OSHEMT Transparency - An organisation may evaluate its OSHEMT progress and consider implementing OSHEMT-T using the best available option that suits its situation, such as an electronic system, WhatsApp, biller board, and flyer issuance. The organisation should also provide details of the planned start date for OSHEMT-T implementation and evaluate its progress regularly. It is crucial to share relevant information about the organisation's OSHEMT management, such as total accident cases, healthcare, and noise exposure status, transparently with employees and the community, without any concealment. This will help employers accurately assess OSHEMT progress and make future improvements based on honest feedback. Researchers believe that by utilising this OSHEMT technology, small and medium manufacturing companies can effectively reduce and regulate loud noise in the workplace.

4.0 CONCLUSION

4.1 Summary and Implications/Significance

This article discusses a segment of a larger study that aimed to create a noise-free environment in SMEs. The study employed the ADDIE model of instructional design, incorporating mixed-method research involving both quantitative and qualitative data analysis, particularly during the analysing and evaluation phases of ADDIE. This study involved observing industrial practices, conducting open-ended response surveys, and interviewing employees and employers of five companies.

Producing more skilled or competent employees is crucial to foster awareness of noise management in the workplace. Management commitment plays a pivotal role in budgeting through HRD Corp. for training, seminars, and motivation, including annual audiometric tests and noise engineering control methods.

The OSHEMT process through ADDIE and andragogy is an ongoing endeavour, based on TNA, aimed at cultivating skilled or competent individuals in the workplace. Employers must implement administrative and PPE controls for short-term noise management

Audiometric analysis of the survey data revealed that 57.14% of workers at the Le Hu Feedmill suffered from hearing impairment in both ears, marking the highest record. This finding correlates with the highest number of samples with six to ten years of service, indicating that work duration is a contributing factor to audiometric test failure. Furthermore, the study found that industrial practices often failed to comply with legal requirements and lacked a sufficient management culture, as indicated by scrutiny and interview findings. Case examples were analysed to identify andragogical approaches to address these issues and provide suggestions for improvement.

The results revealed that noise in manufacturing industries negatively impacts employee health, resulting in a high prevalence of hearing loss among the respondents. By leveraging andragogy approaches, such as CePSWaM OSH-C competence practices, noise risk assessors, TTT, and ADDIE, OSHEMT can enhance the working environment by managing noise exposure and mitigating employee hearing loss. This study recommends that employers conduct NRAs to gauge noise exposure levels in the workplace, particularly in response to noise complaints.

If the background noise exceeds the permissible exposure limit of 82 dBA, noise reduction measures must be implemented, and personnel exposed to excessive noise levels should undergo audiometric evaluations along with medical examinations. Only qualified noise risk assessors who have undergone competence-based learning can conduct NRAs such as initial or advanced NRAs. The results of all dimensions and noise observations should be recorded for seven years. Finally, managers should develop engineering or administrative control systems based on the NRA results and provide earplugs to all employees exposed to noise.

4.2 Limitations and Recommendations

However, this study acknowledges the limitations of the number of variables considered, which may not fully encompass all the factors affecting SMEs' OSHEMT results. This review relied solely on correlation studies and connection reviews. Future studies could explore inferential methods to test hypotheses with larger, more representative data from small and medium-sized businesses located in the Bukit Rambai Industrial Area or the Melaka SMEs manufacturing sector. It is crucial for employers to implement ADDIE when practising OSHEMT in the workplace to attain a cleaner, noise-free work area.

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