Research Article

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Cognitive Fitness of Post-Retirement Employees in Control Room Settings

Kristiana Asih Damayanti*

Ari Widyanti

Hasrini Sari

Yassierli

Industrial Engineering and Management Department,
Faculty of Industrial Technology,
Institut Teknologi Bandung, Indonesia
**Corresponding Author*

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Abstract

The increasing number of post-retirement workers in the workforce has become a global trend due to efforts to extend the working period after retirement, which is implemented by many countries considering the rapid aging of their populations. While the presence of post-retirement workers can have positive impacts on personal, company, and government levels, they face challenges in interacting with equipment through interfaces that require heavy reliance on cognitive abilities. Cognitive abilities become more important than physical abilities in multitasking jobs that require a lot of interaction with technology, such as control room jobs. These jobs require a high level of attention, concentration, and decision-making ability, making them highly demanding and challenging. This study aims to determine how post-retirement workers meet job demands in the control room, based on identification of critical cognitive abilities. The method employed in this study is divided into two stages. The first stage involves identifying tasks in the control room based on Cognitive Task Analysis (CTA) and identifying critical tasks using risk assessment and Focus Group Discussion (FGD). FGD was conducted on four different types of companies (telecommunication, broadcasting, process industry, and electrical power) that still employ retired workers in the control room jobs. The second stage involves measuring cognitive abilities in 116 individuals aged 56-60 years. The results of CTA indicate there are critical cognitive abilities in control room jobs, such as reasoning, attention, memory, and perception ability. According to the measurement, post-retirement workers (56 - 60 years old) had the problem of improving reasoning, attention, and perceptive ability, despite cognitive capacity measurements remaining in the medium range. In general, post-retirement workers have high memory abilities (above 500), while their abilities in recognition, perception, coordination, and attention are only at 200-400 (a medium level), indicating a decline in cognitive abilities for post-retirement workers. The high memory ability is positive for supporting work in complex systems, while improvement of cognitive abilities is needed for the declining cognitive aspects. Implication of this study were discuss to this paper to consider factors that affect critical cognitive abilities in post-retirement workers when recruiting and training them to work in the control room.

Keywords: *cognitive ability, post-retirement workers, and control room jobs*

1. Introduction

According to the International Labor Organization (ILO), there will be a large increase in the number of post-retirement workers aged 50 and over by 2025 in Europe, America, and Asia (Ilmarinen, 2005). This is in line with what has been conveyed by Calzavara et al.(2019), that since 2005, in countries within the Organization for Economic Cooperation and Development (OECD), there has been a significant increase in the number of post-retirement workers (aged 55-64). The increase in the number of post-retirement workers is in line with efforts to extend the working period after retirement for workers (Nilsson, 2020; Nilsson & Nilsson, 2021), where this policy is widely implemented by countries that are beginning to consider the rapid aging of their populations (Nilsson & Nilsson, 2021). The extension of working period and the increase in the number of post-retirement workers can be seen as both positive and negative.

In addition to economic factors, the positive impact of the increase in post-retirement workers can also be seen personally, where post-retirement workers who choose to continue working are actually physically, socially, and mentally healthier and experience a lesser decline in cognitive abilities compared to those who are no longer working (Atalay et al., 2019; Caines et al., 2020; Cheung, 2013). For companies, the presence of post-retirement workers has a positive impact because post-retirement workers are more experienced (Souza et al., 2019), can provide a better sense of stability and responsibility for the company (Findsen, 2015; Kumar & Srivastava, 2018), and also excel in work resilience and interpersonal relationships (Bal et al., 2011). These positive impacts have led some companies and governments to create policies to increase senior age participation in work (Caines et al., 2020).

Interacting with equipment through interfaces requires workers to rely more heavily on their visual focus and memory (Cohen et al., 2018; Gallo & Santolamazza, 2021). In this context, cognitive abilities become more important than physical abilities (Hunt & Madhyastha, 2012), as workers must use their ability to interact with tools and think simultaneously in decision-making processes (Cavallo et al., 2021; Madonna et al., 2019; Wolf et al., 2018). Cognitive ability is a part of a person's mental capacity for processing information and making decisions (Fisher et al., 2017; Parasuraman, 2011; Wickens et al., 2013). According to Kuncel et al. (2010) and Parasuraman (2011), cognitive ability is necessary in multitasking jobs, which are typically associated with jobs that require a lot of interaction with technology.

The challenge for post-retirement workers is the interaction with technology that demands a high level of cognitive ability for attention, memory, and execution. According to Fisher et al. (2019), declining cognitive ability with age is most pronounced in basic cognitive abilities such as memory, attention, numerical ability, reaction speed, and others, while cognitive abilities related to executive function remain relatively stable or even improve. Salthouse (2012; 2009) also note that there is a decline in cognitive abilities such as memory, visual spatial, reaction speed, and reasoning from the age of 35. Based on a study conducted by Gosselin et al (2022), retirement also exerts an influence on cognitive abilities (Bonsang et al., 2012), albeit varying depending on the profession prior to retirement. In the case of surgical doctors, it was found that there was no significant difference between older and younger individuals (Drag et al., 2010), their cognitive abilities remain intact, particularly when associated with task performance.

Control room jobs involve monitoring and controlling complex systems, such as industrial plants, power grids, traffic management systems, and others (Knisely et al., 2021). The operator in the control room is responsible for monitoring and controlling a large number of variables, such as temperature, pressure, flow rates, and other parameters, to ensure the system is running smoothly and efficiently. They also need to respond quickly to any system malfunctions or emergencies. To perform this job, control room operators need to interact with various types of technology, such as computer systems, sensors, alarms, and other control devices, to collect data, analyze it, and make decisions. They need to have a good understanding of how the technology works and be able to use it effectively to manage the system (Iqbal et al., 2020; Lei et al., 2021).

Control room jobs require a high level of attention, concentration, and decision-making ability (Iqbal et al., 2020; Lei et al., 2021). Operators need to be able to process a large amount of information quickly and accurately, make decisions under pressure, and respond effectively to emergencies. The complex and constantly changing nature of the systems they manage requires them to be able to multitask effectively and be adaptable to changing circumstances. Overall, the combination of the complexity of the systems being managed and the high level of technology involved makes control room jobs highly demanding and challenging. It requires workers with a high level of cognitive ability, good technical skills, and the ability to work well under pressure.

Control rooms are chosen as the object for observing complex work that requires cognitive abilities due to their critical role in managing complex systems and processes. Control room operators are responsible for monitoring and controlling a wide range of equipment and systems in real-time, which requires a high level of cognitive ability (Braarud, 2021; Iqbal et al., 2020). Control rooms are also designed to provide a high level of support for these cognitive abilities. For example, they are equipped with advanced monitoring and control systems that provide operators with real-time feedback and alerts to potential issues. They also provide a rich visual display of information, such as graphs, charts, and video feeds, which help operators to quickly identify patterns and anomalies (Iqbal et al., 2020; Knisely et al., 2021).

Impairments in cognitive abilities can have significant implications for decision-making, situational awareness, and response times in control room jobs. Control room operators are responsible for monitoring and managing complex systems, making critical decisions, and responding promptly to potential hazards or emergencies (Lei et al., 2021). In terms of decision-making, cognitive impairments can hinder the individual's capacity to weigh risks, consider alternative courses of action, and anticipate potential outcomes. Difficulties in memory and attention may lead to incomplete or inaccurate assessments of the situation, resulting in suboptimal decisions (Iqbal et al., 2020; Kim et al., 2021). Situational awareness, which involves understanding the current state of the environment and the implications for future events, can also be impacted. Cognitive impairments may impede the individual's ability to gather and process relevant information, leading to reduced awareness of critical cues or changes in the surroundings. This diminished situational awareness can result in delays or errors in identifying and responding to emerging threats or changes in circumstances (Kirkwood, 2019). Response times can be significantly affected by cognitive impairments as well. Slowed cognitive processing or difficulties in retrieving information from memory can lead to delays in recognizing and reacting to stimuli or making timely decisions. These delays can have serious consequences, particularly in time-critical situations where swift and accurate responses are vital (Lei et al., 2021). Understanding the relationship between cognitive impairments and these key cognitive functions is crucial for designing interventions, support systems, and accommodations to mitigate the negative effects and optimize performance in individuals with cognitive challenges.

Based on the above explanation, the purpose of this study is to identify the cognitive abilities that support critical tasks in the control room, and to determine the cognitive abilities of retired workers (post-retirement workers) in meeting the demands of these tasks. Cognitive demand correlated with working condition and employee well-being (Madonna et al., 2019; Mohammadian et al., 2022), so this study was conducted to identify which cognitive abilities need to be taken into consideration and improved/enhanced for post-retirement workers so that they can meet the demands of their job. As said by Hayward and Majmundar (2018) that the most important and challenging in research of aging is to measure the cognitive function.

2. Methods

The study was conducted by a survey of companies and measuring the cognitive abilities of individuals aged 56-60 years old using the Cognifit application. The first part of this study involved identifying a task list for the control room based on literature and focus group discussions (FGD).

From the task list, the cognitive abilities which required to support the execution of the task list ware identified. The next step was to identify critical task lists into risk assessment criteria (Saitta et al., 2017) based on FGDs attended by control room managers from four types of companies surveyed in Indonesia.

Survey conducted at four companies in Indonesia that have control room division and still employ post-retirement workers aged over 56 years (the usual retirement age limit in Indonesia). These four companies operate in the telecommunications, process industry, broadcasting media, and in electric power sectors. In the telecommunications company, it involves monitoring fault handling reports that must be monitored by workers. In the process industry, it relates to controlling and managing the processing of raw materials on machines. In broadcasting media, it relates to controlling and ensuring that live broadcasts can run smoothly. And in the electricity company, it relates to controlling and ensuring the smooth distribution of electricity to all areas. The Manager of the control room of each company was involved in the FGD to identify the control room task list based on the task list (Knisely et al., 2021) and determine the task list category based on risk assessment (Saitta et al., 2017).

The FGD session took place for roughly two hours and was attended by four managers who were supervised by the researcher. Initially, a list of control room tasks based on Knisely et al. (2021) was presented to the FGD participants. Each participant assessed which tasks were applicable to their respective company's control room work, given the differences in company types. During the following session, the four FGD participants engaged in a discussion to identify the control room tasks that were indispensable, could impact system performance, and needed to be executed. The evaluation of critical tasks was initially done individually by each participant and later discussed collectively.

The second part of the study involved measuring the cognitive abilities of individuals aged 56-60 years old. This age range corresponds to the post-retirement worker category defined by Calzavara et al.(2019) and was chosen considering that the surveyed companies still employ workers after retirement age (above 56 years old). The participants (137 people: 62 females (45.3%) and 75 males (54.7%)) were selected by purposive sampling method based on their age within the range of 56-60 years old (56.79 ± 1.08), physical and mentally healthy (based on interview), minimum education of college (73.1%) and maximum education level of having a bachelor's degree (26.9%), knowing basic English, and being actively engaged in screen-based activities on smartphones or computers for the past week.

All participants filled out a consent form as an agreement to participate in this study. An initial screening was performed to ensure that those measured had normal cognitive abilities (no indications of cognitive impairment) by measuring with MoCA. Out of 137 people measured, 21 had MoCA scores below 26 (mild cognitive disorder), so the measurement using Cognifit application was only conducted on 116 individuals who had MoCA scores ≥ 26 (normal category). Cognifit App. was chosen because it can measure cognitive abilities that are sufficiently comprehensive according to the results of the previously identified cognitive needs for the task list. Cognifit also is also recommended for use in measuring cognitive abilities in a mobile setting and for the purpose of determining which cognitive abilities can be trained (Shatil, 2013; Yaneva et al., 2022). Cognifit measures five cognitive abilities, each of which is broken down into various specific abilities. Cognifit scores range from 0 to 800, with low to very high categorization per 200 points.

Based on the two parts of data collection, an analysis was conducted on the cognitive abilities of post-retirement workers to meet the job demands of the control room.

3. Result and Discussion

The identification of cognitive abilities required in the task list was identified from literature studies from (Hunt & Madhyastha, 2012; Knisely et al., 2021; Lei et al., 2021; Madonna et al., 2019; Rodriguez et al., 2019; Sternberg & Sternberg, 2012). This study identified the cognitive ability needs in jobs related to technology and also in highway operator jobs, where the type of work performed is similar to that of the control room job. Knisely et al.(2021) identified cognitive ability based on the Bloom taxonomy, Hunt & Madhyastha (2012) identified based on the list of cognitive abilities required in the USA job market, Lei et al (2021) identified cognitive ability grouped into four main tasks for highway operators, and Sternberg & Sternberg (2012) and Madonna et al. (2019) identified cognitive ability based on the needs of Industry 4.0. The results of this identification can be seen in table 1.

Table 1. Identification cognitive ability for control room task list

Control Room Task List	**The required cognitive ability**				
	(Knisely et al., 2021)	(Hunt & Madhyastha, 2012; Rodriguez et al., 2019)	(Madonna et al., 2019)	(Sternberg & Sternberg, 2012)	(Lei et al., 2021)
1. Communication activities (visually detecting process movements)					
1.1 Observing process/distribution/movements visually on each screen	Perceptual Ability	Attention, perception	Observation	Attention	Multi-object visual tracking
1.2 Receiving visual signals if there is any input/action required in the process/distribution	Perceptual Ability	Attention	Observation	Attention	Multi-object visual tracking
1.3 Identifying the type of visual signals that appear (color, different display, flow)		Perceptual speed	Interpretation	Perceptual visual	Cognitive flexibility
1.4 Identifying the part where the visual signals appear	Comprehension	Reasoning, perception	Execution	Decision making	Logical reasoning
1.5 Focusing on the part where the visual signals appear	Reflexive Movements	Attention, reasoning	Observation	Decision making	Cognitive flexibility
1.6 Identifying the correlation with other parts of the process	Comprehension	Attention	Observation	Attention	Multi-object visual tracking
1.7 Determining the input that needs to be done	Knowledge	Reasoning	Interpretation	Logical Reasoning	Logical reasoning
1.8 Inputting the required value/information	Reflexive Movements	Memory, reasoning, perception	Execution	Knowledge	Working memory
1.9 Observing the progress of the process movements after inputting	Comprehension	Memory, written expression	Execution	Knowledge	Working memory
2. Communication activities (auditory activities)		Attention	Observation	Perceptual visual	Cognitive flexibility,
2.1 Receiving auditory signals (sound)	Perceptual Ability	Perception			
2.2 Distinguishing the source/type of auditory signals (for multiple)		Perceptual speed	Interpretation	Perceptual	Logical reasoning
2.2.1 Recalling the received auditory signals	Knowledge	Attention, perception	Interpretation	Perceptual	Task switching
2.2.2 Identifying siren signals/from prominent screens	Comprehension	Memory, reasoning	Execution	Knowledge	Working memory
2.2.3 Identifying communication call signals	Comprehension	Attention, reasoning	Interpretation	Attention	Logical reasoning
2.3 Conducting communication		Attention, oral comprehension	Execution	Attention	Logical reasoning, Planning
2.4 Identifying things that need to be done	Comprehension, knowledge	Reasoning, perception, oral comprehension	Execution	Language	Logical reasoning
2.5 Observing process/distribution movements on the screen while conducting communication	Comprehension	Memory, reasoning	Interpretation	Decision making	Cognitive flexibility, Logical reasoning
2.6 Recalling previous instructions/information	Knowledge	Attention, oral comprehension	Observation	Attention, language	Logical reasoning
2.7 Ensuring normal conditions (visually) after communication activities	Knowledge	Memory, reasoning	Planning	Knowledge	Working memory
3. Activities related to tactile		Memory, Attention	Observation, Execution	Problem solving	Task switching
3.1 Identifying signals related to tactile					
3.1.1 Receiving vibration signals	Perceptual Ability	Perception		Perceptual, Knowledge	Working memory
3.1.2 Identifying vibration signals	Comprehension	Perceptual speed, reasoning	Interpretation	Perceptual	Logical reasoning
3.1.3 Observing and remembering what needs to be done when receiving such signals	Knowledge	Attention	Interpretation	Knowledge	Cognitive flexibility
3.2 Operating keyboards/buttons/tools according to signal instructions	Reflex Movements, Knowledge	Attention, Memory, perception	Planning	Decision making, problem solving	Working memory

The results of the risk assessment for each task list were based on the FGD. Different types of control in each company's control room resulted in a general agreement on which task lists are included in critical tasks and which are not. In Table 2, there are six critical tasks that have been identified. These critical tasks involve observing processes, movements, or objects on the screen; receiving and identifying signals; communicating; observing objects while communicating; and integrating all received signals to make decisions. These six tasks are related to different cognitive abilities as listed in table 1. The cognitive abilities that are most related to the critical tasks according to the basic cognitive ability by Hunt & Madhyastha (2012) are attention, perception, reasoning, memory, and oral communication language.

Table 2. Risk assessment matrix of control room task list

Probability of occurance		**The potential risks associated with improper execution**				
		Catastrophic	**Critical**	**Moderate**	**Minor**	**Negligible**
Definition	**Meaning**	System shutdown, resulting in significant losses (deaths, fires, etc.)	Momentary system stoppage due to uncorrectable input/decision errors for critical task fulfillment	Process disruption due to correctable input errors, with prompt corrective action for work efficiency	Correctable errors without significant impact can be corrected later	No impact
Frequent	Occurs frequently, will be continuously experienced unless action is taken to change events	1.1		2.3, 1.3		
Likely	Occurs less frequently if corrective action is taken Documented through surveillance		4.1, 2.5, 2.4	1.7, 1.8, 1.9, 2.1, 2.2.1, 2.2.3, 2.4, 4.4, 4.5, 5.2, 5.3	2.6, 2.7, 6.1, 6.2, 6.3	
Occasional	Occurs sporadically. Discovered through surveillance	1.2	1.3, 1.4, 4.3, 7.1, 7.2, 7.3		3.2	
Seldom	Unlikely to occur. Rarely, if ever, reported		1.5		3.1.3, 5.1	
Improbable	Highly unlikely to occur. Never previously reported Risk				2.2	2.2.2

Table 3 presents the results of cognitive ability measurements in participants aged 56-60 years old. The Cognifit measurement yielded scores for each cognitive ability indicator and its details. As shown in table 3, the cognitive abilities of the participants were at a medium and high level. High cognitive abilities were observed in most of the memory categories and some in attention and perceptual abilities. Medium cognitive abilities, according to Lei et al. (2021), are required for tasks in the control room, which require high cognitive reasoning, memory, planning, and execution abilities. Therefore, there are some challenges to improving medium cognitive abilities such as reasoning, attention, and perception.

Table 3. Cognitive ability measurement result by Cognifit

Cognitive criteria	**Cognitive ability score (mean, std. dev)**	**Category**	**Cognitive criteria***	**Cognitive ability score (mean, std. dev)**	**Category***
Overall	399.91 ± 98.77	Medium	Inhibition	389.50 ± 235.20	Medium
Reasoning	381.44 ± 162.04	Medium	Updating	363.72 ± 227.99	Medium
Shifting	256.16 ± 239.54	Medium	Divided attention	338.59 ± 237.23	Medium
Planning	475.47 ± 263.49	High	Focused Attention	422.29 ± 216.34	High
Processing speed	403.16 ± 194.04	High	**Coordination**	401.59 ± 149.96	High
Memory	401.79 ± 153.83	High	Hand-eye coordination	368.25 ± 190.90	Medium
Non verb memory	413.58 ± 261.54	High	Response time	435.19 ± 238.75	High
Visual Short term memory	475.74 ± 274.38	High	**Perception**	320.32 ± 57.18	Medium
Naming	455.63 ± 177.11	High	Spatial perception	348.88 ± 191.71	Medium
Contextual memory	426.75 ± 160.35	High	Estimation	253.50 ± 101.15	Medium

Cognitive criteria	Cognitive ability score (mean, std. dev)	Category	Cognitive criteria*	Cognitive ability score (mean, std. dev)	Category*
Working memory	332.65 ± 87.46	Medium	Width of field of view	524.76 ± 179.12	High
Short term memory	443.79 ±284.74	High	Auditory perception	401.18 ± 45.36	High
Phonological short term memory	267.27 ± 138.90	Medium	Recognition	522.73 ± 126.90	High
Attention	379.17 ±145.47	Medium	Visual perception	379.25 ± 90.26	Medium
			visual scanning	492.14 ± 238.39	High

*Category of cognitive ability score based on Cognifit measurement: low: 0-200, medium: 201-400, high: 401-600, very high: 600-800

Based on critical task analysis and table 3, reasoning plays an important role in decision-making activities (Monge et al., 2016) and when dealing with jobs that require situational awareness (Kästle et al., 2021), such as those in the control room. According to Salthouse (2009), reasoning abilities decline with age, but this study found that reasoning abilities in the 56-60 age group still fall into the medium category, with some aspects of reasoning such as planning and processing speed still high. Processing speed is particularly helpful for decision-making in the control room, and according to Anglim et al. (2019), reasoning ability also determines work attitudes. Therefore, older workers can still perform jobs related to reasoning, but efforts are needed to improve it to a high level, especially in general reasoning ability and shifting ability. Interestingly, the Cognifit measurement results show that the memory abilities of the participants are still relatively high. This indicates that the participants are still capable of performing tasks that require memory abilities, not only critical tasks, but also almost all tasks in the control room. According to Oberauer (2019), memory plays a crucial role in controlling attention and perception. Therefore, even though attention and perception values are only at a medium level, with high memory abilities, attention and perception can be trained, as shown in the study by Yagi et al.(2020), where cognitive control can be exercised and plays an important role in perception and reasoning. Therefore, based on these measurement results, post-retirement workers should not have difficulty in the control room. However, according to Buitron (2017), the memory ability most demanded of operators is working memory because of the demands of the job to quickly respond to something. According to Redick et al. (2016), good working memory ability is essential in multitasking jobs, such as those in the control room. Based on the measurement results, working memory ability in the 56-60 age group is at a medium level, so the biggest challenge is how to improve working memory ability at this age. Training to improve working memory ability can also improve fluid intelligence ability (Jaeggi et al., 2008), which includes basic cognitive abilities such as reasoning.

The ability to pay attention plays an important role in almost all tasks in the control room and technology-related work (Thompson & Mayhorn, 2012). Control room work is mostly done by observing and paying full attention to the processes or objects that are visible on the monitor, so the ability to pay attention is essential. However, this attention ability also needs to be supported by the ability to support decision making such as perception and reasoning (Lei et al., 2021).

From the measurement results in the table 3, it is found that the attention ability of individuals aged 56-60 is still classified as medium, so the challenge to improve attention ability is still needed. Some ways to improve attention ability are through physical exercise (Muiños, 2018), attention games through brain training (Harris et al., 2018), and the use of technology (Rehman & Cao, 2020).

Coordination ability is only required in one critical task, so even though the measurement results for individuals aged 56-60 are at the medium level, this condition still allows post-retirement workers to perform well in the control room, especially since their response time is high. According to Nakamura et al.(2018), good response time will help in jobs that require high cognitive performance. Therefore, in this ability, the participants do not have high challenges.

Perception ability is the ability to interpret information obtained through sensory perception (Ghosh et al., 2021), usually in the form of visual and auditory objects in control room work. This ability supports the three critical tasks identified in table 1. All decision-making activities usually require perception and reasoning abilities. The decline in perception ability in seniors is usually influenced by physical conditions that start to decline, such as vision and hearing (Lentz et al., 2022; T. A. Salthouse, 2009).

Based on the measurement results in table 3, the perceptual ability of individuals aged 56-60 is at a medium level, but their auditory and recognition abilities are high. The challenge to improve perception ability is related to spatial and visual perception, which is still at a medium level, where this ability is the main part of perception that supports control room work (E. Kim et al., 2014; Lei et al., 2021). Some ways to enhance perception include improving or maintaining sensory abilities such as visual, auditory, and sensory training (Roberts & Allen, 2016). Brain games or activities can also be used to train and improve perception abilities (Ghosh et al., 2021; Kornmeier & Bach, 2014).

The study aimed to identify the cognitive abilities required for control room jobs and assess the cognitive abilities of individuals aged 56-60 years old. The study found that attention, perception, reasoning, memory, and oral communication language are the most related cognitive abilities to critical tasks in control room jobs. The participants' cognitive abilities were at a medium and high level, with high memory abilities and some attention and perceptual abilities. However, the study identified some challenges in improving cognitive abilities such as reasoning, attention, and perception. Therefore, training to improve these abilities is essential, particularly for older workers who may face declines in their cognitive abilities with age. In the previous study (Damayanti et al., 2021), differences were found between the cognitive abilities of post-retirement workers and younger individuals, but only in specific aspects, namely reasoning, attention, and perception. These differences were not observed in all factors of cognitive abilities. Therefore, the focus on enhancing cognitive abilities in post-retirement workers can be based on the findings presented in Table 3, as explained above.

The study suggests that physical exercise, brain training through attention games, and the use of technology can help improve attention abilities. Improving working memory ability can also enhance fluid intelligence ability, including basic cognitive abilities such as reasoning. The study also found that the ability to pay attention is essential for almost all control room tasks, and attention needs to be supported by the ability to make decisions such as perception and reasoning.

Overall, this study has implications for improving the performance of older workers in control room jobs by providing insights into the cognitive abilities required for these jobs and identifying ways to improve these abilities. The findings of this study can help organizations develop training programs that are specific to the cognitive abilities required for control room jobs and tailor them to older workers' needs. The study highlights the importance of assessing cognitive abilities in older workers to ensure they are capable of performing critical tasks in control room jobs effectively.

4. Conclusion

Based on the identification of cognitive abilities required in the job and possessed by post-retirement workers, it was found that out of the five measured cognitive abilities, participants aged 56-60 years had medium to high levels of cognitive ability. The cognitive abilities that still need to be improved in post-retirement workers to meet job demands are reasoning, attention, and perception. The limitation of this study is that participants' daily activities were not considered, so in the future, other factors that affect cognitive abilities can be considered. This study also still has limitations as the measured respondents are limited in number and variety of activities. Further research can also consider environmental factors and work patterns such as shift work that can have varying impacts on cognitive demands. Cognitive ability measurement using other methods can also be used for comparison and to complement measurement with Cognifit App. Several ways to improve these abilities include physical activity, brain game use, or technology. Future research is needed to develop methods or tools to enhance the reasoning, attention, and perception abilities of post-retirement workers to meet job demands.

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