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Beyond Comfort: Ergonomics in Engineering Education and Design

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Abstract: In "Beyond Comfort: Ergonomics in Engineering Education and Design," this review looks at how ergonomic points help make health care places better. It checks how training programs can help reduce hard physical work troubles and stop bone and muscle problems. In terms of teaching, the paper looks at how ergonomic ideas are added into courses, focusing on new teaching ways for better worker performance. It also talks about differences in new learning places, like learning through computer-made realities, and old-style classrooms in engineering teaching. The paper points out many ergonomic problems professionals face in different areas like health care during big health crises, building places, farm work, and fixing railway systems. There are also talks of new tools and changes, like better wheelbarrows and different hospital beds, to make things easy and safe for users. The main idea of the book is to talk about the design and change of tools, work systems, and teaching plans to make ergonomics strong, reduce health problems, and make work output better.

Keywords: Ergonomics, Engineering Education, Health Care

1.0 INTRODUCTION

"Beyond Comfort: Ergonomics in Engineering Education and Design" talks about how ergonomics plays a big part in everyday life and jobs. This paper shares ideas about how ergonomics helps, from health care places to schools. In health care, there's a push to make work easier and safer, thinking of good ergonomic ideas from worldwide groups. Schools in Iran show there's a need to teach ergonomics from young ages. This paper also looks at how technology, like computer-made learning, changes how engineers study. It also looks at problems from jobs in farming places far away to train tracks in India. This paper talks about new ideas, like better carts in Hyderabad or hospital beds for people who had a stroke, to fix these problems.

1.1 NAVIGATING HEALTHCARE: ERGONOMIC HURDLES AND REMEDIES

In the healthcare field, many ergonomic problems touch on areas like patient safety, worker's health, and service quality. When these problems stay without solution, the quality of healthcare might

go down, and costs might go up. In the world of hospital patient care, Torres, Rodríguez, and Buitrago (2021) show there's a big need to make things work better with ergonomic ideas in Colombia. Their study talked about many things that need better ergonomic solutions, like how to store and handle materials, how to handle patients safely, and how to control infections. By making these changes, patients get better care, and healthcare workers can do their jobs in a safe and good way. During the time of COVID-19, many new ergonomic problems came. Lee et al. (2022) talked about the hard work of healthcare workers in New York who had to handle people who died because of the virus. These workers had more risk of hurting their bones and muscles. To help them, there were ideas like getting special equipment and changing how facilities look and work. All these changes can help workers stay safe and feel better in their mind. More studies should look at how these changes work in the long term. Education about how to handle patients safely is very important. Wren and Burlis (2020) talked about teaching medical students how to move and handle patients without harm. In their program, students learning physical therapy teach medical students. This new way of teaching helps medical students learn better and makes different medical people work together better. More studies should see how this kind of teaching works in different places and with different medical jobs. In the world of medicine, many people get shots with syringes. But, these syringes can sometimes hurt patients or medical workers. Ishak et al. (2021) tried to make a new kind of syringe that is safer. They made many models in 3D and tested them. Their final syringe worked very well and can help reduce the danger of these injuries. Future work should see how this new syringe works in real hospitals and clinics. In hospitals, moving things around with trolleys is common. But, manual trolleys can cause ergonomic problems and can hurt workers. Sanjaya et al. (2020) had an idea to use a machine platform instead of manual trolleys. Their idea can make the work of moving things in hospitals safer and faster. More work is needed to see how this machine platform works in real life. Lastly, moving patients from beds is very important in hospitals. People who had a stroke, their caregivers, and nurses often find it hard to move patients from beds. This can slow down the patient's recovery and can be hard for the workers. Gumasing, Villapando, and Pernia (2019) made a new design for a wheelchair bed. This design has many good features to help move patients easily. More studies should test this design in real hospitals

to see if it helps workers and patients. This review paper brings all these findings together to give a simple view of the big ergonomic problems in healthcare and the new ideas to solve them.

1.2 INTEGRATING ERGONOMICS INTO EDUCATION AND WORK

Ergonomics is very strong in many areas. From looking after people in hospitals to building things and teaching in schools, ergonomics helps a lot. In the time of COVID-19, New York health workers had many problems. Lee et al. (2022) looked at how to keep bodies safe in big places like morgues. Workers had a big risk of getting hurt, so new ways were found to make things safer. They changed how places looked and bought special things to help. If health places are designed thinking about ergonomics, less people get hurt and patients get better help. Future works must look at how good these new ways are and make rules for big death events. In Colombia, Torres et al. (2021) tried to make a hospital safer using rules from the International Ergonomics Association. They found ways to make things better like controlling infection, organizing work, and moving things. When these good ergonomics ways are followed, hospitals work better and workers are happier. It is important to keep researching to see how these changes help patients and workers in the hospital. For schools, Kashani et al. (2020) looked at school books in Iran. They saw that ergonomics is not talked about much, especially about sitting in a bad way and how products are made. This shows that there should be more talk about ergonomics in school books. When students learn about ergonomics early, they will work in safer ways when they grow up. Good teaching about ergonomics makes students healthier and values good ergonomics ways. In another study, la Torre et al. (2020) saw that many students in Sapienza University in Rome got hurt, especially nursing students. They got hurt by things like sharp things and getting hit. Universities must find out why students get hurt and find ways to teach students to be safe. For teaching, Bayley and Hurst (2018) made a new way to teach balancing lines. They used online videos and active learning to help students understand ergonomics better. This new way of teaching helps students learn in the way they like. This teaching talks about moving things and changing times, showing how good new teaching ways are for learning about ergonomics. In building, Smallwood and Deacon (2019) talked with building workers. They found that many parts of the body, like the feet and back, hurt a lot. Building work is hard, so it is very important to know and fix ergonomics problems. This way, workers will be safe and happy in their jobs.

1.3 FROM CONCEPT TO APPLICATION: EVALUATING AUGMENTED REALITY'S ROLE IN ENGINEERING LEARNING

Augmented Reality (AR) is not just a new technology. It becomes a big player in engineering teaching. It gives students a deep look into the subject by letting them touch and move virtual things in real-time. Because of this, they can understand hard ideas better. Guo (2018) did a study on this. It showed that students who learn with AR using Microsoft HoloLens understand manual material handling (MMH) much better than others. At the same time, in manufacturing studies, Bayley and Hurst (2018) mixed online videos and student activities. Students got better at many things like material handling. They think this mix of old and new teaching can help students more in the future. In another field, medical engineering, there was a problem. Doctors didn't have a good tool for practicing a special surgery for children. Millán et al. (2018) made LAP-SPUR. This tool, made of things that can be used again and some things that can't, is very realistic. Doctors liked it a lot. They said it was just like the real thing. This is good because doctors can practice more and make fewer mistakes in real surgeries. Ergonomic design is a study about making things easy and safe to use. Esteban et al. (2020) made a special cart with six wheels for carrying things. It was made with Fusion 360 software. People found it very good for manual work. Gumasing et al. (2019) changed the design of hospital beds in the Philippines. Their bed is safer and more comfortable for moving patients who had a stroke. As more old people get sick, this bed can keep them and the hospital workers safe. Harari et al. (2019) tried to make manual work better with a new method. Their method can increase work by 105% without making workers tired or hurt. Radin Umar et al. (2019) made a new cart for big metal sheets. It can make workers' positions better, do things faster, and need fewer people. These tools and ideas are very important for industry. They can make work better and safer.

1.4 DIVERSE DIFFICULTIES IN JOB FIELDS: HOW ERGONOMICS TEACHING MATTERS

Many types of work across various areas come with their own sets of challenges that sometimes hurt the health of workers. One common health problem from these jobs is injuries linked to work, and

many times these are musculoskeletal disorders. Over time, more and more people have noticed these injuries and realized we need to do something to stop them before they happen. So, teaching about ergonomics has become important to help keep workers safe and feeling good. This teaching gives workers special knowledge and ways to do things that fit the kind of work they do. The goal is to lower how often these injuries happen and make them less bad when they do. By always using and changing these ways of teaching, it is hoped that work places will be good for a long time. In farm work, especially in places that are not big cities, face injuries (maxillofacial injuries) are a problem that happens a lot (Vaibhav N. et al., 2021). Looking at data from three years showed that many farm accidents are these kind of injuries. This tells us that these injuries are serious and can really hurt the well-being of farmers. Because of this, there's a big need to make machines safer, give clear safety instructions, and teach people how to be safe (Vaibhav N. et al., 2021). More learning is needed to understand how teaching about ergonomics can help stop these injuries. If farmers know more, they can get help faster if they get hurt. There's some disagreement about if teaching about ergonomics really helps with muscle pain. Some papers looked at many studies and said that there's not strong proof that this teaching always helps (Rodrigues Ferreira Faisting A.L. & de Oliveira Sato T., 2019). But, this doesn't mean it can't help. Maybe future studies can look at teaching in more detail and try combining it with other ways to help. If we try different teaching ways and ask people what they think, maybe we can find better ways to teach. The virus called COVID-19 brought many new problems. One of these was for people working in morgues in New York who had a higher chance of getting musculoskeletal injuries because of the way they had to move bodies (Lee T. et al., 2022). This showed how important it is to be ready for unexpected things. With more teaching, better places to work, and special tools, they could handle this risk, but more study can find better ways for if something like this happens again. Regular teaching and practice can also make morgue workers more ready for big health problems in the future. In India, people who keep railway tracks in good shape often feel muscle pain. Their job makes them stand and move in ways that hurt, especially in their knees, hands, and lower back (Das B., 2020). Trains are important in India, so these workers need to be taken care of. Teaching them better ways to stand and move, and giving them better tools could help. In the future, more study can show if these changes really help over a long time. Working together - researchers, railway bosses, and the workers - can find

the best ways to solve these problems. Lifting things by hand can hurt the body and cause musculoskeletal disorders. Studies have shown that workers often feel pain, especially in their legs (Curbano R.J.P., 2018). This not only hurts the worker but can also make the job slower. Some tools, like NIOSH, can show which ways of lifting are risky, and this information can be used to find better ways to lift in the future. Telling workers more and using new technology can give full answers to these problems. People who work with fish often get musculoskeletal disorders because they work in wet places and have to stand and move in ways that aren't comfortable for a long time (Patel J. & Ghosh T., 2023). This can make them work slower and miss days of work. Many of them feel pain in their neck and lower back. Because of this, it's important to find ways to help them. Better tools and work places can make their job easier and less painful. People who are very good at lifting by hand and those who are new do not lift in the same way. The ones with a lot of experience hurt their shoulders less when they lift things (Goubault E. et al., 2022). This tells us that good teaching and experience are important for safe lifting. In the future, more studies can make teaching programs that are perfect for people who are new to lifting. Getting advice from experts can make these programs even better. In small workplaces in North Karnataka, workers often feel pain when they lift things by hand. They often move in ways that are risky and hurt (Humpli A.S. et al., 2021). These workplaces sometimes don't know the best ways to do things safely. In the future, more studies can focus on teaching these workers and the people in charge. By sharing this knowledge, workplaces can be safer and work can be done faster.

1.5 BRIDGING THE ERGONOMIC GAP: FROM CLASSROOM LEARNING TO PRACTICAL IMPLEMENTATION

In current, dynamic work environments, there is a visible need for ergonomic strategies to enhance the safety and efficiency of workers. This demand intensifies with the progression of industries, emphasizing the safety and effectiveness of their workforce. The connection between ergonomics, technology, and educational methods is supported by various studies. For example, Gonella et al. (2019) discuss the obstacles in creating flexible training programs for manual jobs because of different working situations. Taking feedback from the field and customizing training to different work environments makes the learning process more effective. In terms of technology's role in ergonomics, Bayley and

Hurst (2018) showcased the use of a blended learning model for better line balancing, using online videos to enhance student comprehension of ergonomic issues in manufacturing industries. This approach shows how technology can transform education, offering dynamic and flexible learning experiences. Another educational method highlighted by Wren and Burlis (2020) is a collaborative strategy in the medical domain, where physical therapy students educate medical students, enriching their understanding and promoting teamwork in healthcare. Focusing on equipment, Ou et al. (2020) examined forklift drivers' behaviors to optimize cab designs, ensuring the comfort and efficiency of drivers who spend long hours there. In a similar realm, Susihono et al. (2018) addressed musculoskeletal complaints in workers by proposing an ergonomic Standard Operating Procedure (SOP), highlighting the importance of ergonomic practices in reducing workplace injuries. For manual handling tasks, Jäger (2018; 2019) offers research-backed advice, developing a more ergonomic approach based on detailed autopsy measurements. In another sector, Morejon et al. (2019) put forward a stretching regimen for those handling gas cylinders, a job known for its specific ergonomic challenges. On the economic side, Diefenbach and Glock (2020) introduced a design for U-shaped order picking systems, aiming to make them both productive and less strenuous, underlining the need for a balance between profitability and ergonomics. Concerning younger generations, Chua et al. (2019) analyzed the ergonomic shortcomings of trolley school bags for primary school students, indicating that ergonomics isn't just an adult concern. They stressed the importance of designing ergonomically sound educational tools, ensuring young learners grow without physical setbacks caused by poorly designed tools.

2.0 METHODOLOGIES

Merging ergonomics into different areas, shown in the introduction, is very important for the safety and good health of workers. In the paper "From Hospitals to Morgues: Ergonomic Challenges and Solutions in Healthcare," it talks about big ergonomic problems in healthcare. In another paper, "Bridging the Ergonomic Gap: From Classroom Training to Real-world Implementations," it speaks about how technology and ergonomics can work together. It's clear that thinking about ergonomics in different ways is needed. To deal with these problems, the next part explains many methods. Rapid Entire Body Assessment (REBA) helps check posture risks, the Questionnaire method gets ideas from professionals, Motion Capture (MoCAP) looks closely at how people move, and the Cornell

Musculoskeletal Discomfort Questionnaire (CMDQ) checks problems from work. All these methods, from digital ways to watching, help understand ergonomic problems and find ways to fix them.

2.1 RAPID ENTIRE BODY ASSESSMENT (REBA)

The Rapid Entire Body Assessment, known as REBA, presents a way to examine the postural risks that many workers face in different work surroundings. The main idea behind this approach is to give priority to worker health and safety through ergonomics. From the world of ergonomics, this evaluation method helps spot and address musculoskeletal problems caused by unsuitable work postures. This is important as musculoskeletal disorders (MSDs) are common work-related health problems, which often result in taking extended time off work. In the REBA approach, worker posture is observed during specific jobs. It's then compared to certain standards, after which a risk score is given. When using this structured approach, higher scores show bigger risks. This signals that actions should be taken quickly. The main goal is to improve the way work is done, decrease injuries, and make sure human performance is at its best, ensuring good health for the workers over a long time. In logistics, Nabil L. & Dahda S.S. (2022) used the REBA approach to check the packing process in PT. XYZ's logistics department. They saw the importance of good ergonomics in making operations smoother and keeping employees healthy. They spotted problems with work posture and ergonomics, which showed there were big ergonomic risks that needed fast changes (Nabil L. & Dahda S.S., 2022). Looking at agriculture, which often demands hard physical work, Rao C.A., Prakesh B.S., & Pandit S. (2023) studied push carts used manually in Hyderabad. They noticed that vendors work many hours, which makes ergonomic solutions important. Their study found ergonomic problems with vegetable sellers. They suggested a new cart design based on ergonomic ideas to help with the found musculoskeletal problems (Rao C.A., Prakesh B.S., & Pandit S., 2023). Even in the car-making industry, there are ergonomic problems. Cuautle Gutiérrez and team (2021) found posture risks during the final touches of car part making. Knowing how fast the car industry changes, it's very important to bring in ergonomic solutions for the safety of workers. With the help of REBA and other methods, they came up with new design ideas to lessen the chance of musculoskeletal injuries (Cuautle Gutiérrez L., Uribe Pacheco L.A., & García Tepox J.D., 2021). In factory settings, where the same tasks are done over and over, Syafei and others (2023) made the plastic wrapping process better in terms of ergonomics and work output. They showed that

ergonomic solutions can give two benefits at once. Using REBA and other methods, they suggested an ergonomic trolley for plastic wrapping (Syafei M.Y., Riyanto A., Sianturi G., & Nafisa H., 2023). Similarly, Humpli's team (2021) looked at the ergonomic risks of handling materials by hand in small work units in North Karnataka. In such small units, it's very important to think about ergonomics. They found problems with posture and the way materials were handled, pointing out how important it is to think of ergonomic ways to protect workers (Humpli A.S., Qutubuddin S.M., Sohail A., Prashnat T., & Ahmed M.A., 2021). In the tough oil and gas industry, Saptari's group (2023) thought about changing manual material handling to a partly automatic way. Their study showed how ergonomics and work output are connected. Their results showed the good points of making this change, showing both fewer musculoskeletal problems and lower costs (Saptari A., Ng P.K., Junardi M., & Taslim A., 2023). For railway work in India, which needs a lot of manual labor, Das B. (2020) found many musculoskeletal problems with track keepers. The hard physical work makes it important to think about ergonomics. Using REBA, they suggested ways to make the work less hard (Das B., 2020). At the same time, Bortolini's group (2020) talked about the Motion Analysis System (MAS) that changes human moves during factory tasks into digital information. In today's Industry 4.0, digital tools are very important for better ergonomics. By combining movement capture with software tools like REBA, they gave ideas to make work output better and protect worker health (Bortolini M., Faccio M., Gamberi M., & Pilati F., 2020). In the same way, in factories where tasks can get boring, Realyvásquez's team (2018) talked about ergonomic problems when changing forklift brake pads. They know that even everyday tasks can have big ergonomic risks if not noticed. After checking, they suggested an ergonomic table to make the observed postures safer (Realyvásquez A., Hernández-Escobedo G., & Macías A.A.M., 2018). Widodo's group (2019) studied how materials are handled manually in PT. XYZ. This study shows that it's always important to think about ergonomics in different industries. They showed the big need for ergonomic solutions, finding out that workers were carrying too much weight and had physical problems. If not looked at, this could cause health problems later (Widodo L., Daywin F.J., & Nadya M., 2019).

2.2 QUESTIONNAIRE

Questionnaire means a set structure with questions to get answers from people. Many use it in research to take the main data and can ask in person, by phone, or on the internet. Many academic,

business, and social studies have this. It is good because it can take both number and word data, as the study needs. To do a good questionnaire, first think what the study wants. Make questions easy and fair, and give many answer choices for all people. After making questions, must test them first to see if any problems. Testing helps make questions clear and right. When the questionnaire is ready, give it to the people being studied. Then, take the answers and study them using math methods to understand and make decisions. Zhao and group (2022) studied problems in storage places, mainly putting things on high and low shelves. Many storage workers have pain in the back. So, they used both questionnaires and a system to watch movements. Their paper showed different movements for both processes and how risky they were. Their work can help train and make better work places for these workers. In the same way, Rao and group (2023) looked at problems for people selling vegetables in Hyderabad. They wanted to make the carts better, so used questionnaires and checked the body. What they found helped make a new cart based on good design ideas. This paper shows how good design helps even small sellers. Kamble and friends (2022) studied problems of farmers in Haryana, India who pick cotton by hand. They watched them, asked questions, and talked to them. Many old farmers had body pain because of bending for long time and not knowing about chemicals. This paper says we need to think about good design even for old farming ways. Abraham and group (2022) tried to reduce body pain for storage workers in building work. They used many ways like questionnaires and watching movements, and found bad postures when moving things. They suggested safer ways to stack. Their paper can help other works to keep workers safe. In a study on food storage in India, Adhaye and Jolhe (2023) tried to make manual work better. Using many tools like questionnaires, they gave many suggestions from changing tasks to better paths. Their paper says we need to think about all parts of a problem. Pinheiro and group (2023) mixed business study with questionnaires. By studying processes and looking at work conditions, they showed how both ways together solve problems. This way shows how different studies can help together. Looking at making medical things, Yusof and Shahida (2021) studied pain in workers in Malaysia. Using a special questionnaire and talking to workers, they found pain in the back and shoulders. Their work says we need to find special solutions for every kind of work. Workers making fish in Suri, studied by Patel and Ghosh (2023), had problems because they worked in wet places for long. Using a changed questionnaire, they found big pain and said we need to make work better. This

shows we need to change work to keep workers safe. Mahmood and team (2022) studied firefighters when they roll hoses. By watching and using questionnaires, they suggested new tools to reduce body injury. This paper looks at a job not many think about, but still needs good design. Lastly, Das (2020) looked at railway workers in India and found many body problems. Using a changed questionnaire and a method, the paper ended with suggestions like better tools and exercises. Das's work says even old industries need to keep checking and making better.

2.3 MOTION CAPTURE (MOCAP)

MoCAP means a top technique to change human movements into computer data quickly. This technique takes live human actions and changes them into digital shape to show the movements on a screen. For this, people wear special marks, and cameras catch their movements. Then, the computer makes a digital shape that copies the person's movement. This is a good tool in many areas like movies, health studies, and engineering. In movies, it makes characters look real, and in games, it makes movements feel real. Because of this, many like it in technology. When doing MoCAP, people wear these marks or sensors. Cameras see these and track them when the person moves. This data goes to a computer that makes a digital figure that acts like the real person. This digital figure can then be changed or studied for the purpose it is needed. MoCAP gives a clear view of movements, so professionals can see tiny details in how people move. Valverde and group (2022) made a model to change workspaces based on body size and movement to make fewer people miss work. MoCAP, with other tools, checked the model to see if it helped workers stand and move better and feel less tired. If workers feel good, they work better and like their jobs more. Gründler and team (2021) used different methods to see and make better machines for cleaning blood. They wanted these machines easy and safe, so workers don't get tired and patients get good treatment. Iranzo and team (2022) used MoCAP and muscle testing to see how a back support tool changes muscle work during manual tasks. This support tool looked promising to decrease work pain. This can change industries with a lot of manual work and make fewer people get hurt. Bortolini and group (2020) showed a Motion Analysis System (MAS) that mixed MoCAP with computer programs. This system looked at work, made it better, and took care of workers in factories. With technology and thinking about people, factories can make more goods and keep workers happy. Yadi and Kurniawidjaja (2019) worked on good design for the chemical making

industry. MoCAP helped to test and confirm solutions for problems like bad standing positions. With this study, safety can be better, and work feels good. Feldmann and group (2019) made the Key Indicator Method (KIM) digital with MoCAP. This new system helps companies see how workers stand when picking things, making work safer and the same everywhere. Zhang and team (2019) used sensors and MoCAP to see how tired construction workers get. This study shows that MoCAP can watch workers all the time. By seeing how tired workers get, fewer accidents might happen. Wang and group (2020) used 3D pictures and a computer method with MoCAP to see construction workers' actions and make workplaces focused on good design. These studies make places safer and work faster. McDonald and team (2020) saw how shoulder muscles work during push and pull. MoCAP was important to understand muscle work with different hand positions and ways of pushing or pulling. This helps in making workplaces and tools that are good for human bodies.

2.4 SURFACE ELECTROMYOGRAPHY (SEMG)

Surface Electromyography (sEMG) is a way that doesn't hurt and measures the electric work of muscles under the skin. It sees electric signs that make muscles tight and shows muscle working and tiredness now. Doctors, people who study, and sports persons can watch and check how muscles work in different situations. It's good for healing places, better sports results, and checking work safety. Because it doesn't hurt, there's no need for surgeries or injections. In sEMG, small things called electrodes are put on the skin to catch the electric work of muscles. These signs are made bigger, cleaned, and checked to know how muscles work. Some things like how well the electrode sticks to the skin and where it's put can change the results. Preparing the skin and putting electrodes right is important to get good data. Computers help to show this electric work as pictures. This makes it easier for professionals to understand and decide what to do. Giannini and friends (2020) made a system to wear that has sEMG and another thing called Inertial Measurement Units (IMU) to check body problems during hand tasks. Old ways often weren't the same and didn't use real numbers. This new system made checking better by following ISO 11228 rules and allowed a full body check. This made checking better and gave a full idea of hand tasks, making better plans to fix problems. Wadeson and team (2020) used sEMG to see how stretching changes muscle work when moving gas bottles. Their study found that stretching made some muscles work less and others work more. This study made people think differently about

stretching and showed that every person is different and might need different things to stay safe at work. Bassani, Filippeschi, and Avizzano (2021) talked about the need for data that has body movement and muscle work information. They got data from many people doing hand tasks with IMUs and sEMG. Their data, which has full-body movement and arm muscle work, is important for checking work safety from body checks to risk checks. This mix of data gives a full idea of hand tasks and the problems they can cause. For helping patients, especially with brain problems, sEMG is very important. Ranavolo, Serrao, and Draicchio (2020) said sEMG can help patients go back to work. But they also said there are some problems to solve to use sEMG right. There's a big need for training from different areas to make sEMG work better for healing. Because it's so important, many places teach professionals how to use this for patients. When working with robots that help people, like the study by Varrecchia and group (2023), it's important to see how robots change how muscles work together. They found that these robots can make muscles work better together and can make workers less tired and hurt less. This can make work better and safer. Some studies, like Skovlund and group (2022), look at very special tasks, like putting things on supermarket shelves. They learned about how high to lift, how heavy the load is, and how much muscle work is needed. These ideas can help reduce pain in workers. Many people who work in shops have body pain, so this can change how workplaces are made and how workers are taught. At the end, putting sEMG in work tools, like the one called Exo-LiFFT by Zelik and team (2022), shows how important it is. These tools can check if things like body supports reduce the chance of getting hurt without needing many sEMG checks. As computers get better and people learn more about safe work, tools like Exo-LiFFT can change industries to make them better and safer for workers.

2.5 INERTIAL MEASUREMENT UNITS (IMUS)

Inertial Measurement Units, often called IMUs, are electronic instruments that record and tell about an object's speed, direction, and the pull of gravity. This is done with accelerometers and gyroscopes. Because of new technology, IMUs are now smaller and cost less. This means many people can have them. They are very important in systems for planes and cars, but now they also help in studying how the human body moves, in virtual reality, and in designing safe workspaces. IMUs are very good at finding out how things move. They have accelerometers that tell how fast something is moving in a straight line, and gyroscopes that tell how fast it is turning. This information can then be

used to know exactly where something is and which way it is facing. When IMUs are used with other tools like magnetometers or GPS, it gives a full idea of how something or someone is moving in space. This is why they are very helpful in research where knowing every detail of movement is important. Nurse et al. (2023) studied technology you can wear, especially IMUs, to see dangers of hurting the lower back when carrying things. Their smart way combined many sensors. They looked at how the body moved and how much weight was on the feet. Their results matched what people actually saw. This shows that using many sensors together with special computer steps can make very good tools to tell about dangers in real-time (Nurse et al., 2023). Humadi et al. (2021) compared different tools to see which one is better for understanding safe work methods. They looked at IMUs and Kinect V2, which is a camera system. They found that IMUs matched very closely to what special cameras saw. The camera system like Kinect V2 had problems because sometimes it could not see everything (Humadi et al., 2021). Muller et al. (2022) tried to make better ways to understand how the back carries weight during work. Instead of just looking at movement, Muller's group also looked at forces. Their new way showed it might be possible to know about forces without having to measure them directly. When they compared it to old ways, like special cameras and platforms that measure force, they found it might be good for studying work methods (Muller et al., 2022). Bassani et al. (2021) made a big collection of information from people doing work tasks. They used IMUs and also studied muscle activity. This big collection might help many other studies. It can help to understand how the body works, risks in the workplace, and how people move (Bassani et al., 2021). Humadi et al. (2021) looked closely at how accurate IMUs are for understanding risks in work tasks. What they found was good. When IMUs were set up in a certain way, they gave very exact measurements. This is good news compared to old ways that sometimes did not give the same answers every time (Humadi et al., 2021). Donisi et al. (2022) tried a new way to automatically tell about dangers in how people move. They used IMUs and made a special computer model. This model was good at telling dangers based on a known method called the Revised NIOSH Lifting Equation (RNLE). This new way can help a lot, especially for workers who need special care to go back to their jobs safely (Donisi et al., 2022).

2.6 NIOSH LIFTING EQUATION

The National Institute for Occupational Safety and Health (NIOSH) Lifting Equation is a well-known formula that gives advice on safe lifting. This equation was made to help people avoid hurting their backs and other body parts when lifting things. At the heart of this formula is the Recommended Weight Limit (RWL). RWL tells the most weight a person should lift safely in different situations. By knowing the RWL, workers and those who employ them can decide how to lift things without getting hurt. This way of thinking is good because it tries to stop problems before they start. It shows that using research to decide how to work safely is a good idea. The NIOSH Lifting Equation is not just numbers; it is very important for keeping workers safe. To get the most from this equation, people must look closely at many things. They need to know where the object is, how high it is lifted, how long lifting takes, how the lifting is done, and how the hands hold the object. All these things decide the RWL. If someone lifts something heavier than the RWL says, that person might get hurt. So, companies use this formula to work better, keep workers safe, and maybe spend less money on problems from lifting. Murugan et al. (2023) looked at problems in the cloth-making business where workers hurt their muscles and bones, especially when lifting by hand. By using many tools, including the NIOSH lifting equation, they found out where the biggest dangers were. This not only showed where changes were needed but also started more research to see if these changes really helped workers stay healthy. Adhaye and Jolhe (2023) studied big places in India where food is stored. They used the NIOSH Lifting Equation to see what problems workers had. Their work showed where the biggest problems were, like how to carry things better, how to hold them, and how to move around. This showed how useful the formula is for finding out how to help workers. Chua et al. (2019) studied school bags with wheels that young students pull. They found that these bags might not be good for children's backs. This shows that the NIOSH Lifting Equation can be used in many places, not just where adults work. Gumasing and Sasot (2019) wanted to understand the problems faced by people who pick up trash in the Philippines. By using the NIOSH Lifting Equation, they found many risks, from small injuries to big health problems. They also saw that things like the weather and the work schedule can make these problems worse or better. This shows that there are many things to think about when trying to keep workers safe. Lastly, Barim et al. (2019) wanted to make the Revised NIOSH Lifting Equation even better. They thought about

adding things like how old a person is, how tall they are, and how their body is built. Their work showed that making the equation fit each person might be better for knowing who might get hurt. This could lead to even better ways to keep people safe in the future.

2.7 ERGONOMIC CHECKPOINTS

Ergonomic Checkpoint is a tool made to help find and fix working conditions in many places. Its history is linked to work in factories where doing things well and safely was very important. This tool gives advice to workers and those who hire them. It helps bring ergonomic ideas to different places, like factories or offices. By finding dangers and problems, the Ergonomic Checkpoint starts the process of making important changes for the safety of workers and to do things better. Places that follow these ideas often see fewer people getting hurt and work being done faster. To start using an Ergonomic Checkpoint, the first thing is to look closely at how people are working now. Knowing how things are now helps decide what to change. This includes looking at how things are carried, where people work, if machines and tools are safe, and how work is planned. The tool believes in talking with both bosses and workers when looking at the work. Talking to everyone helps find the best ways to fix problems since workers know what is difficult for them. After finding problems, good solutions that don't cost much and are easy to do can be suggested. Checking the work again and again, and listening to feedback can help keep making things better. This way, problems can be stopped before they start. Pérez E. et al. (2021) used the Ergonomic Checkpoints tool in a place in Colombia where they process meat. Processing meat has many manual tasks that can be hard for workers. The main thing they wanted was to bring ergonomic ideas to the way they produce and serve, especially in countries where these ideas might not be common. They looked closely at how materials are stored, the tools in workers' hands, and the design of the place they work. They gave both technical and organization solutions and also showed the workers 3D pictures to help them understand better. These 3D pictures help make the ideas clearer. More research can check how these changes help over time and see if the tool can be used in other kinds of jobs, like farming or technology work. Torres Y. et al. (2021) talked about the importance of ergonomic ideas in hospitals, to keep both the workers and the patients safe. They used the Ergonomic Checkpoints in Health Care Work from the International Ergonomics Association (IEA) in a part of a hospital in Colombia. They found problems with how things are carried, where nurses work, and how to stop

sickness from spreading. These things can affect how well patients are taken care of. Their work showed that following ergonomic rules and working together can make hospitals work better. More studies can look at hospitals in other countries, to see the real results of these changes and if patients are happier and healthier because of them. Khalid H. et al. (2019) made a special kind of Ergonomic Checkpoints for both inside and outside work places. Made by the Southeast Asian Network of Ergonomics Societies (SEANES), these checkpoints looked at six technical parts, like talking and facilities for workers. Places where people work outside have their own problems because of the weather and the land. These checkpoints want to make ergonomic ideas clearer and motivate workers to make their workplaces, like offices or building sites, safer. More research can look at how these checkpoints help in different places and see if fewer people get hurt because of them. Kogi K. et al. (2019) talked about the need for special ergonomic ways for places where people give health care. Health workers often work a lot and feel stressed, so ergonomic ideas are very needed. They made 60 ergonomic checkpoints for health work, looking at ten important technical parts, like dangers and facilities for workers. Made with help from the International Labour Office (ILO) and the International Ergonomics Association (IEA), these checkpoints try to find easy ways to make things better and reduce all kinds of risks. This not only looks at physical problems but also how health workers feel overall. Their first tries with these checkpoints showed that conditions for health workers got better. More research can see how these checkpoints can be used in different health places and if they really make health workers and patients feel and do better.

2.8 CORNELL MUSCULOSKELETAL DISCOMFORT QUESTIONNAIRE (CMDQ)

The Cornell Musculoskeletal Discomfort Questionnaire (CMDQ) is an important tool in ergonomic study. This tool is good for checking and understanding work-related muscle discomfort (WMSDs) in many jobs and sectors. Because there was a big need to check and manage ergonomic problems at work, this tool was made. CMDQ is good for looking closely at how many people have WMSDs and how bad it is. It helps to find ergonomic problems in work areas, making jobs safer. How do professionals work with CMDQ? Mostly, workers get this questionnaire like a survey. It has questions about different parts of the body. These questions try to find out how much and how often a

person feels discomfort or pain when they work. When all answers come back, many things can be learned from the data. After checking this data, important information about how ergonomic a place is can be found. This information helps professionals make changes to make the workplace better. Also, the information from CMDQ can be a starting point for more ergonomic checks, so the workplace keeps getting better. In the world of research, many have talked about CMDQ. Yusof A. and Shahida M.S.N.'s (2021) paper in the International Journal of Automotive and Mechanical Engineering talks about this. They used CMDQ to check WMSDs in a medical factory in Malaysia. They also did interviews to understand better. They found out that most discomfort was in the lower back, shoulders, and upper back. This information is very helpful for people who want to make workplaces safer (Yusof A. & Shahida M.S.N., 2021). Another paper from the Iran Occupational Health journal by Karimi A. et al. (2020) had a different goal. They wanted to see what happens when ergonomic changes and manager decisions are done together for dairy workers, especially those making milk. They used CMDQ and another method called Quick Exposure Check (QEC) to see worker posture. They found that when ergonomic changes and good manager decisions are done together, workers feel better (Karimi A. et al., 2020). Yusof A. and Shalahim N.S.M. (2020) checked ergonomic problems in another medical factory in Malaysia. They had other tools, but CMDQ was the main one. They found that many workers had problems, especially in the lower back. This shows that lifting things in the wrong way can be bad for the body (Yusof A. & Shalahim N.S.M., 2020). Another study by Gumasing M.J.J. and Sasot Z.B. (2019) in the 2019 IEEE 6th International Conference on Industrial Engineering and Applications looked at garbage collectors in the Philippines. They used CMDQ and found many work risks, like injuries and WMSDs. They saw that things like age, BMI, and noise can make these risks worse. This information helped them think of ways to make garbage collectors' work safer (Gumasing M.J.J. & Sasot Z.B., 2019).

3.0 FUTURE RESEARCH IN ERGONOMICS EDUCATION

The value of ergonomics in many areas, like health and engineering education, gets more attention in new papers. Methods like the Rapid Entire Body Assessment (REBA) and Surface Electromyography (sEMG) help a lot in dealing with problems, especially ones linked to muscle disorders. These tools are used in different situations, like checking posture risks at work or watching muscle work as it happens. When thinking about what's next, some research ideas want to study

ergonomics more, like using augmented reality in engineering education, focusing more on health solutions, and using ergonomics in different jobs. One big thing in the future will be moving from just learning about ergonomics to actually doing it. Combining what's learned from these methods with new research ideas will give a full view of ergonomics problems and ways to solve them, with the goal of making work safe and efficient for everyone.

3.1 ERGONOMIC HURDLES AND RESOLUTIONS IN HEALTHCARE ENVIRONMENTS

The paper sketches seven study themes regarding ergonomics within the healthcare arena. It indicates study fields such as verifying the efficiency of ergonomic checkpoints in multiple healthcare facilities, emphasizing the merit of collective learning for ergonomic techniques in morgues, and the fusion of self-operating systems with ergonomic standards. Additional subjects discuss developing universal frameworks for ensuring safe transfers, observing the influence of ergonomically-forged medical implements on healthcare worker safety, reviewing ergonomic answers for material handling, and understanding the continued reliability of ergonomic tactics amidst emergencies. Each projected research has roots in earlier discoveries from diverse scholars and suggests ways for further study.

1.0 Assessing the Utility of Ergonomic Checkpoints in Various Healthcare Establishments: Based on combined insights from Torres Y. et al. and Lee T. et al., there exists a curiosity to learn how ergonomic values, like the Ergonomic Checkpoints, could be applied in not just nursing departments but also in sensitive places such as morgues, particularly during emergencies like the COVID-19 outbreak. Study approach includes comparing different sites, a collective strategy, and evaluations in assorted healthcare units.

2.0 Collective Learning for Ergonomic Techniques in Morgues: Wren M.E. et al. revealed the importance of joint education in communicating safe patient care. Bringing this idea to incorporate teachings on secure deceased handling in morgues might answer the ergonomic hurdles mentioned by Lee T. et al. Research method includes designing a joint learning session amongst medical and forensic pathology learners followed by a subsequent efficiency evaluation.

3.0 Merging Self-operating Systems and Ergonomic Checkpoints in Healthcare: Blending the perspectives of Torres Y. et al. and Sanjaya K.H. et al., there lies potential in studying how self-operating devices, like robot-assisted hospital carts, can be structured with ergonomic checkpoints for patient well-being and operational enhancements. Investigation method comprises design deliberations, model creation, and assessment in real-time hospital surroundings.

4.0 All-encompassing Safe Transfer Blueprints for Patients and the Deceased: Relying on the knowledge from Gumasing M.J.J. et al. and Lee T. et al., a void exists in crafting all-inclusive ergonomic systems for the safe movement of both the living and the departed, emphasizing protector measures for healthcare givers. Study technique encompasses ergonomic rules, mutual design sessions, and model evaluations in medical settings.

5.0 Effect of Ergonomically-Fashioned Medical Tools on Healthcare Worker Well-being: Ishak M.I. et al. accentuated the role of ergonomic structuring in syringes to avert harm. Expanding this thought, there's a chance to probe the overarching influence of diverse ergonomically-fashioned medical tools on healthcare giver safety. Research method comprises comparative investigations contrasting conventional versus ergonomic apparatus, centering on injury occurrence and prevention methods.

6.0 Scrutinizing Ergonomic Answers for Hospital Material Management: Torres Y. et al. together with Sanjaya K.H. et al. signify that managing materials presents ergonomic hurdles in hospital settings. A concentrated study might appraise the supremely effective ergonomic resolutions particularly tailored for material management and storage. Investigation approach includes observation, ergonomic checkpoint reviews, and user feedback sessions in different healthcare establishments.

7.0 Sustained Dependability of Ergonomic Tactics in Emergency Scenarios: Lee T. et al. underlined the ergonomic difficulties during widespread fatality events such as the COVID-19 pandemic. The persistence and continued efficiency of ergonomic resolutions during these emergencies remains a topic needing more exploration. Study method consists of prolonged examinations of the ergonomic resolutions employed during emergencies and their lasting influence on worker health and protection.

3.2 INTEGRATING ERGONOMICS IN EDUCATIONAL CURRICULUM

In presented research topics, different ergonomic problems and their answers are shown. These start from looking at the long-time results of ergonomic actions when many people die to adding ergonomic studies in schools in many places. The role of mixing learning ways to make better ergonomic decisions in factories is talked about. Also, there is a focus on adding more ergonomic points in health places, not only for nurses. Talking about ergonomic troubles in building jobs and finding out why students in university get hurt in different subjects is also noticed. Each subject gets help by a special research way to give clear ideas and solutions.

1.0 Evaluating Long-Term Ergonomic Interventions During Mass Fatalities - Based on Lee T. et al.'s paper on ergonomic problems during COVID-19 time, finding out how long safety actions help workers is important. Methodologies: Long studies looking at ergonomic answers when many people die, with a focus on worker health and safety.

2.0 Incorporation of Ergonomic Education in Global School Systems - From Kashani M.M. & Zamani-Badi H.'s article about ergonomic learning in Iranian school books, comparing how ergonomic subjects are taught in different countries is helpful. Methodologies: Looking at ergonomic subjects in school books from different places to see their effect on student understanding and health.

3.0 Blended Learning's Impact on Ergonomic Decision-Making in Manufacturing - Based on Bayley T. & Hurst A.'s mixed learning way to teach how to balance, looking at how it helps students in

factory work is needed. Methodologies: Comparing different teaching ways for ergonomic ideas in factories.

4.0 Expanding Ergonomic Checkpoints Beyond Nursing Units in Healthcare - Because of Torres Y. et al.'s idea of Ergonomic Checkpoints for nurses, trying this in more health places might be good. Methodologies: Trying Ergonomic Checkpoints in different health places to see how it affects patient safety and how workers feel.

5.0 Addressing Ergonomic Concerns in the Construction Industry - Smallwood J. & Deacon C.'s paper about ergonomic troubles in building shows that new ways might be needed. Methodologies: Trying new building methods, with better ways of organizing work and teaching.

6.0 Exploring Injury Causes Among University Students Across Disciplines - La Torre G. et al.'s words about Sapienza University student injuries show that more understanding about injuries in different study subjects might be good. Methodologies: Looking at why students from different subjects get hurt to find ways to stop these injuries.

3.3 ASSESSING THE IMPACT OF AUGMENTED REALITY IN ENGINEERING EDUCATION

In the review paper "Future Research in Ergonomic Education", Augmented Reality (AR) and its potential impact on engineering teaching is the main focus. The paper points to seven areas of research that might help in improving both engineering and healthcare methods.

No 1, "Evaluating the Efficacy of AR Tools in Enhanced Engineering Learning", is rooted in Guo W.'s findings which discussed the potential benefits of AR over the usual classroom setups. It is argued that by comparing AR's role in different engineering education topics, more knowledge can be gathered. The methodology suggests exploring a variety of AR platforms and technologies and examining their influence on multiple engineering sectors.

No 2, "Comparing Blended Learning Approaches in Ergonomic Engineering Education", leans on Bayley T. & Hurst A.'s blended learning approach, specifically when teaching line balancing. The importance lies in checking the long-term effects of such teaching methods in different ergonomic

engineering disciplines. The methodology proposed is to conduct comparative studies to observe performance outcomes of students across diverse ergonomic subjects using a range of blended learning techniques.

No 3, "Laparoscopic Simulators in Pediatric Urological Procedures Training", emphasizes a notable point by Millán C. et al. about the scarcity of specific training tools for pediatric ureteral reimplantation surgeries. The paper suggests the creation and validation of these specialized tools. The methodology is to craft a variety of these simulators, test their effectiveness against traditional ones, and then measure the impact they have on patient outcomes.

No 4, "Ergonomic Design Solutions for Manual Material Handling", draws insights from both Esteban Q.M. et al. and Harari Y. et al. It underlines the necessity for designs that ensure safety while being efficient, especially when materials are moved manually. The suggested method involves simulation-based design fine-tuning paired with feedback from users. The aim is to craft ergonomic equipment like trolleys that guarantee both safety and productivity.

No 5, "Ergonomic Innovations for Safer Hospital Bed Transfers", is inspired by Gumasing M.J.J. et al.'s designs of ergonomic wheelchair beds. The paper sees potential for broader applications in the healthcare domain. The methodology recommends blending ergonomic principles, direct observations, and surveys to re-envision and update traditional hospital tools, ensuring both patient comfort and caregiver safety.

No 6, "Optimization of Manual Material Handling Workflows", considers Harari Y. et al.'s simulation-based method, which seems promising for broader applications. The paper insists on crafting workplaces that strike a balance between productivity and worker safety. The methodology is about implementing this simulation-based optimization method in real-life tasks, and then contrasting its efficacy against the traditional task designs, considering both productivity and the welfare of the worker.

Lastly, No 7, "Enhanced Trolley Designs for Efficient Sheet Metal Handling", is based on Radin Umar R.Z. et al.'s observations regarding the challenges with manually handling large metal sheets. The article stresses the requirement for ergonomic solutions in this field. The methodology encompasses refining

the design of trolley-lifters using feedback from users, evaluating its performance across various industries, and carrying out comparative research on productivity, safety, and worker contentment.

3.4 THE UNIFYING ROLE OF ERGONOMIC EDUCATION

In the review paper, "Future research in Ergonomic Education", eight main research subjects concerning ergonomic measures and their impact on varied professional fields and sectors are highlighted.

No 1, "Evaluating Ergonomic Interventions on Maxillofacial Injuries in Farming Activities". This study's rationale is that maxillofacial injuries in farm settings are of significant concern, as noted by Vaibhav N. et al., 2021. The research aims to delve into how ergonomic measures can be practically applied to make an impact. The approach for this study is through longitudinal research, emphasizing ergonomic initiatives and enhancements in machinery designs.

No 2, "Configuration and Content Analysis of Ergonomic Training for Optimal Effectiveness". The need for this research arises from the unclear results on the efficiency of ergonomic training, as discussed by Rodrigues Ferreira Faisting A.L. et al., 2019. The method planned for this research focuses on controlled studies that will inspect the content, the structure, and the combined effectiveness of ergonomic trainings.

No 3, "Long-term Ergonomic Strategies in Decedent Handling during Mass Fatalities". The justification for this topic is based on the ergonomic challenges encountered during the handling of deceased bodies in events like the COVID-19 pandemic, as mentioned by Lee T. et al., 2022. The chosen methodology involves longitudinal studies aiming to evaluate the longevity and health outcomes of the ergonomic controls implemented.

No 4, "Exploring Organizational Factors Influencing Musculoskeletal Health in Railway Workers". This research is essential because railway track maintainers face problems with their musculoskeletal health, a fact presented by Das B., 2020. The study's methodology involves qualitative research that will explore organizational factors in combination with the assessment of ergonomic measures.

No 5, "Impact Assessment of Developed Ergonomic Interventions in Manual Material Handling". The reason behind this research topic is the risks faced by workers who handle materials manually, leading to musculoskeletal disorders, as stated by Curbano R.J.P., 2018. The paper's methodology centers around longitudinal research evaluating the long-lasting effects of ergonomic interventions on the health of workers.

No 6, "Posture and Technique Training Impact on Musculoskeletal Disorders in Fish Processing". Justification for this study comes from the discomfort fish processing workers go through because of their working conditions, as identified by Patel J. et al., 2023. The methodology for this research encompasses studies focusing on training in posture and work techniques specifically for fish processing workers.

No 7, "Transferability of Manual Handling Expertise to Varied Occupational Settings". The significance of this research is the role expertise plays in safe manual handling, which is highlighted by Goubault E. et al., 2022. The approach for this research involves cross-comparative studies examining how expertise can be applied across diverse manual handling settings and tasks.

Lastly, No 8 "Ergonomic Education and Awareness in Small-Scale Industries for MMH Tasks". This research topic comes from the ergonomic challenges faced by small industries in North Karnataka, as pointed out by Humpli A.S. et al., 2021. This study's method is centered around educational initiatives paired with assessments both before and after, to understand worker health and ergonomic risk factors more deeply.

3.5 FROM CLASSROOM TRAINING TO REAL-WORLD IMPLEMENTATIONS

The main emphasis is on eight research subjects touching ergonomic actions and their impacts in varied job areas and sectors. These subjects go from checking ergonomic steps to avoid face injuries in farming jobs to boosting ergonomic teaching in small-sized industries in a place called North Karnataka. The chosen research subjects are because of seen issues in different work areas, like the bone and muscle problems of people working on railways and the problems when dealing with bodies during big death

events like during COVID-19. Each subject comes with a way to deeply check the issue, some with studies over time, some with checks that control variables, and some with deep conversations. The big idea is how ergonomic actions might lessen health problems and make work places better.

No 1, "Evaluating Ergonomic Interventions on Maxillofacial Injuries in Farming Activities", face injuries are big problems in farming (Vaibhav N. et al., 2021). Deep checks can look at how ergonomic actions work in real life. Method for this is studies over time looking at ergonomic steps and better designs for machines.

No 2, "Configuration and Content Analysis of Ergonomic Training for Optimal Effectiveness", talks about how ergonomic training is not clear in its effects (Rodrigues Ferreira Faisting A.L. et al., 2019). The main focus of checks can be to make training content better. Method for this is controlled checks to look deeply into the training's parts and how they work together.

No 3, "Long-term Ergonomic Strategies in Decedent Handling during Mass Fatalities", handling bodies during COVID-19 made ergonomic problems (Lee T. et al., 2022). Future deep checks can see if the ways used will work for a long time. Method for this is studies over time looking at ergonomic ways used and their effects on health.

No 4, "Exploring Organizational Factors Influencing Musculoskeletal Health in Railway Workers", says that people who maintain railway tracks have bone and muscle problems (Das B., 2020). It's important to see how job places influence these health problems. The method is talking deeply to see job place and mind factors, and also looking at ergonomic steps.

For No 5, "Impact Assessment of Developed Ergonomic Interventions in Manual Material Handling", people who move materials by hand have risks for their muscles and bones (Curbano R.J.P., 2018). Checking how the steps taken impact can give new ideas. Method is to do studies over time to see long effects on worker health.

No 6 "Posture and Technique Training Impact on Musculoskeletal Disorders in Fish Processing". People working with fish feel bad because of how they work (Patel J. et al., 2023). Training might make this better. Method is to focus on body position and how people work with fish.

In No 7, "Transferability of Manual Handling Expertise to Varied Occupational Settings", knowing a lot helps in safe manual work (Goubault E. et al., 2022). It's a good idea to see if this knowing can be used in other places. Method is to check using different places and jobs.

Lastly, No 8 "Ergonomic Education and Awareness in Small-Scale Industries for MMH Tasks". Small places to work in North Karnataka have ergonomic problems (Humpli A.S. et al., 2021). Making people know more can solve this. Method is teaching, with checking before and after for ergonomic problems and how workers feel.

4.0 CONCLUSION

Ergonomics is an important science that looks after the good of people in many sectors. From health places to complex engineering places, the power of ergonomic rules is known by all. When looking at the studies talked about before, three big areas stand out: health, teaching, and technology ways. Health places often face problems that can be bad for both patients and health workers. If not looked at, these problems can make medical care bad and make health costs go up. Some studies have given new answers to these problems, showing it's important to keep changing and bettering what people do. One big thing to look at is how well ergonomic steps work in different health units. It's also important to see the good things that come from machines and ergonomic rules working together. This paper thinks there's a need to make systems that help move patients safely and check if ergonomic ways can keep working during big problems. Teaching has seen a lot of ergonomic rules being added. Outside of health, ergonomic rules are now in schools, showing how big they are. But there are still things to learn. Like, the long effects of ergonomic steps during big death events aren't known well. And, more needs to be known about ergonomic checks in health places and why students from different subjects get hurt. Augmented Reality (AR) is now making teaching engineering more fun and deep. With AR, students can learn hard engineering ideas by playing with virtual things. The good of AR is known, but more can be learned about how AR tools help teach engineering. Also, more can be done to make special simulators and add ergonomic designs to moving materials by hand. Different jobs have their own problems, but one thing seen often is injuries from work. These injuries have made it clear that steps to stop them are needed. Studies show that it's important to see how ergonomic steps can stop face injuries

in farming jobs. Also, more needs to be learned about ergonomic teaching in small industries in North Karnataka and the bone and muscle problems of railway workers and the ergonomic problems during big death events. Comparing what is taught in classrooms to what happens in real jobs is a big part of ergonomics. As industries change, keeping workers safe and working well is getting more focus. But, more can be done to learn about ergonomic teaching ways, check ergonomic rules for tools, and see back strength in different job designs. In the end, as industries and the world change, it becomes clearer that a full ergonomic way is needed. By looking at and solving these research questions, safer, better, and lasting places can be made in many areas. The future could have a world where ergonomic rules, new technology, and teaching all work together well, making sure everyone is good and doing well.

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