

## Ergonomic Hazards in the Workplace: Assessment, Evaluation and Prevention in the Educational Environment of Holy Cross College



John Vincent L. Santos<sup>1</sup>, Danielle Larizze O. Gallardo<sup>2</sup>

<sup>1,2</sup>Holy Cross College, Sta. Rosa, Nueva Ecija, Inc.

**ABSTRACT:** This research was conducted to assess, evaluate and prevent the ergonomics hazards in the educational environment of Holy Cross College. College instructors at various workstations across the college facilities are among those that participate. The data was gathered through the use of an online survey form. It consists of 45 questions designed to have insight on the actual equipment setup, work posture, and work design, and environment utilized by the college faculty. The majority of the detected risks are at a critical level and may cause severe loss to the organization's scope, quality, schedule, and cost. The findings provided the necessary safety norms and resources to prevent ergonomic hazards that result in ergonomic health problems. All hazards designated as critical can be kept to minimum if actions and reactions are appropriately implemented by the relevant parties. As a result, the likelihood and magnitude of its occurrence and effects are reduced.

**KEYWORDS:** Ergonomics, Ergonomic Hazard, Risk Assessment

### I. INTRODUCTION

The threat of the COVID-19 pandemic has forced most of the educational and academic institutions around the world to rely on technological advancement to continue the teaching-learning process. This resort has given rise to the usage of electronic devices such as mobile phones, laptops, and personal computers to facilitate distance learning. Academic activities and face-to-face classes have been suspended but the teachers continue the work on the school or the work at home depending on the arrangements made by the school administration.

In the wake of these contingencies made in the learning institutions, the educational environment was pushed to its limits. Changes have been made to ensure compliance with the government's safety protocols against the pandemic. And it affected the way teachers work, the way students learn and the educational environment itself has made improvisations in compliance with the health and safety standards. With the further development and improvisations in the facilities, working and learning facilities must continue to be designed to be relevant, competitive, and fit for its users.

When talking about a work or an environment that fits for its users, ergonomics plays an important part in this aspect. Ergonomics is defined as a technique that brings together several disciplines, such as biological sciences and engineering sciences, to reduce physical hazards and strain on the human body arising from work and the working environment. Ergonomics' main objective is to achieve the optimal mutual adjustment between the user and the work.

In teaching and learning, its possible outcomes may greatly depend on the environment where it is facilitated. The engineering design of the facilities, equipment, and buildings affects the teacher and students' mental and physical performance. Although, the ergonomics approach goes beyond productivity, health, and safety. It also includes consideration of the total physiological and psychological demands of the teachers and students in an educational environment.

The human body can only endure considerable discomfort and stress. Performing many awkward and unnatural movements only for a limited period of time. If the workplace is not designed to minimize ergonomic stress, awkward conditions and motions will continue for a prolonged period of time that may exceed the physiological and psychological limitations of the teachers and students.

The educational institution of Holy Cross College, Sta. Rosa, NE, Inc. takes advantage of the online learning for the college department and a combination of online and modular learning for the basic education department. With the implementation of these new normal modalities, performance and output must remain satisfactory through the utilization of an ergonomically designed educational environment based on the user's capacities and limitations.

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This study is focused on the assessment, evaluation, and prevention of the existing ergonomic hazards present in the educational environment of Holy Cross College, Sta. Rosa, NE, Inc.

## II. LITERATURE REVIEW

According to Hanushek (2009), it attracts the teachers better when the environment where they work is proven to be more pleasant and safe. Ergonomics plays an important part in maintaining a safe environment for teachers, and at the same time boosting their morale and enhancing their productivity. According to Uche (2015), the present age of globalization allows the educational environment to be transformed in its methodologies of delivering an education that is more competent and can fit in the fast-growing world.

Effective teaching and learning process stands heavily on the design of the facilities and equipment used. Ideally, everything a teacher works with is designed specifically to meet the standard needs of a body during work, or it can be adjusted for a better working process. The health, safety, and comfort of the users are of paramount importance. When these criteria are not met, there would be possible excuses and absenteeism due to health challenges from ergonomic hazards. Ergonomic considerations include all equipment and facilities used by the teacher and the properties of the surroundings such as temperature, humidity, and ventilation. Inadequacy in the design of these resources may lead to possible adverse effects on health.

According to Altman (1975), teaching and learning cannot take place when the educational environment is no longer safe, healthy, and comfortable for its users. When a facility is poorly designed, teaching and learning take their toll. Based on the definition of ergonomics, that it is a combination of several disciplines, actual facilities should also be designed collaboratively by several professionals such as teachers, learners, and planners. Assessment and evaluation of the ergonomic hazard by a competent professional is needed and important to make sure that each of the users has their needs met.

## III. METHODOLOGY

The framework of this study is divided in three cyclic phases, namely: Assessment, Evaluation and Prevention of the ergonomic hazards present in the educational environment of Holy Cross College.

. An ergonomic assessment is an objective and subjective quantification of the ergonomic hazards present in the working environment. Following the ergonomic assessment is the ergonomic evaluation. The researcher will evaluate how the workforce interacts with the working conditions, setup, and environment. The research will then lead to prevention through a comprehensive and thorough ergonomic assessment and evaluation.

The researcher considered the faculty of the college department of Holy Cross College, Sta. Rosa, Nueva Ecija as the participants of this study. They are chosen as respondents to identify the ergonomic hazards present in each of their workstations or offices during a pandemic.

The data obtained is from two different sources: objective data based on the answers of the respondents and subjective data based on the evaluation of the researcher. The objective data covers all the direct feedback and responses of the participants in this study. While the subjective data covers the first-hand accounts and insights from the expertise of the researcher that the questionnaire may not cover. When all the data are gathered and complete, assessment and evaluation take place. The researcher has investigated this phenomenon by performing statistical and computational techniques. The researcher used their knowledge in assessing the presence of the ergonomic hazards that will be identified and the potential risks it may bring. Understanding the presence of ergonomic hazards develops insight and opportunities for risk mitigation through risk assessment.

Risk assessment is the act of determining the probability that a risk will occur and the impact that event would have, should it occur. This is basically a “cause and effect” analysis. The “cause” is the event that might occur, while the “effect” is the potential impact to a project, should the event occur.

Assessment of a risk involves two factors. First is the probability which is the measure of certainty that an event, or risk, will occur. This can be measured in a number of ways, but for the ergonomic risks in the Holy Cross College, the probability will be assigned as defined below.

Very High Probability (VHP)	<ul style="list-style-type: none"><li>• Occurs frequently (50-100% chance)</li><li>• Will be continuously experienced unless action is taken to change events</li></ul>
High Probability (HP)	<ul style="list-style-type: none"><li>• Occur less frequently if process is corrected (20-50% chance)</li><li>• Issues identified with minimal audit activity</li><li>• Process performance failures evident to trained auditors or regulators</li></ul>

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Medium Probability (MP)	<ul style="list-style-type: none"> <li>Occurs periodically (10-20% chance)</li> <li>Potential issues discovered during focused review.</li> </ul>
Low Probability (LP)	<ul style="list-style-type: none"> <li>Unlikely to occur (5-10% chance)</li> <li>Minimal issue identification during focused review</li> </ul>
Very Low Probability (VLP)	<ul style="list-style-type: none"> <li>Highly unlikely to occur (0-5% chance)</li> </ul>

The second factor is the estimate of the impact on the organization. The estimated cost, the duration of the potential delay, the changes in scope and the reduction in quality are in most cases factors that can be estimated and documented in the risk statement and then measured using the standard project management tools. This can be measured in a number of ways, but for the ergonomic risks in the Holy Cross College, the impact will be assigned as defined below.

Very High Impact (VHI) / Catastrophic	<ul style="list-style-type: none"> <li>Extreme changes in scope of works (50-100%)</li> <li>Extreme dissatisfaction in the quality of product or service (50-100%)</li> <li>Extreme delay in time (50-100%)</li> <li>Extreme additional cost in the organization (50-100%)</li> </ul>
High Impact (HI) / Critical	<ul style="list-style-type: none"> <li>Major changes in scope of works (20-50%)</li> <li>Major dissatisfaction in the quality of product or service (20-50%)</li> <li>Major delay in time (20-50%)</li> <li>Major additional cost in the organization (20-50%)</li> </ul>
Medium Impact (MI) / Moderate	<ul style="list-style-type: none"> <li>Moderate changes in scope of works (10-20%)</li> <li>Moderate dissatisfaction in the quality of product or service (10-20%)</li> <li>Moderate delay in time (10-20%)</li> <li>Moderate additional in the organization (10-20%)</li> </ul>
Low Impact (LI) / Minor	<ul style="list-style-type: none"> <li>Minor changes in scope of works (5-10%)</li> <li>Minor dissatisfaction in the quality of product or service (5-10%)</li> <li>Minor delay in time (5-10%)</li> <li>Minor additional cost in the organization (5-10%)</li> </ul>
Very Low Impact (VLI) / Negligible	<ul style="list-style-type: none"> <li>Insignificant changes in scope of works (0-5%)</li> <li>Insignificant dissatisfaction in the quality of product or service (0-5%)</li> <li>Insignificant delay in time (0-5%)</li> <li>Insignificant additional cost in the organization (0-5%)</li> </ul>

Very High Probability	5E	5D	5C	5B	5A
High Probability	4E	4D	4C	4B	4A
Medium Probability	3E	3D	3C	3B	3A
Low Probability	2E	2D	2C	2B	2A
Very Low Probability	1E	1D	1C	1B	1A
	Very Low Impact	Low Impact	Medium Impact	High Impact	Very High Impact

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Risk Levels:

- Risk is Very High for codes 5A, 5B, 5C, 4A, 4B, 3A
- Risk is High for codes 5D, 4C, 3B, 2A
- Risk is Medium for codes 5E, 4D, 3C, 2B, 1A
- Risk is Low for codes 4E, 3D, 2C, 1B
- Risk is Very Low for codes 3E, 2D, 2E, 1C, 1D, 1E

Once the hazard identification and risk assessment are complete, the researcher will provide a thorough, actionable report of all the ergonomic hazards and risk factors. Additionally, recommendations will be made to create a strategy that will reduce these risks and improve the ergonomics of the educational environment of the Holy Cross College during a pandemic.

### IV. RESULTS

Using the data gathered, further analysis is made to identify the ergonomic hazards that are present and experienced by the college faculty of the Holy Cross College. Understanding the presence of ergonomic hazards develops insight and opportunities for risk mitigation through risk assessment.

The following table shows the raw data and its corresponding percentage on how it is likely occurring in the educational environment of Holy Cross College. By collectively analyzing the data as one, we can draw out the most likely occurrence of the ergonomic risks. Quantifying the number of those who answered yes and no will give insight on how many college faculty have the potential resource to prevent the common ergonomic hazard using chair. The answer "Yes" generally means that a college faculty have the potential safety resources and practices to reduce or eliminate ergonomic hazards. The answer "No" generally means that there is a lack of adequate ergonomic safety considerations in the equipment setup, work posture, and workplace environment.

Ergonomic Considerations	Average Raw Data		Average Percentage	
	Yes	No	Yes	No
Chair	1.71	12.29	12.24	87.76
Keyboard and Mouse	9.75	4.25	69.64	30.36
Keyboard Surface	8.20	5.80	58.57	41.43
Work Posture	9	5	64.29	35.71
Equipment Layout	7.83	6.17	55.95	44.05
Leg and Knee Room Movement	9.50	4.50	67.86	32.14
Monitor	10.20	3.80	72.86	27.14
Lighting	9.86	4.14	70.41	29.59
Temperature and Humidity	7.67	6.33	54.76	45.24
Work Organization and Task Issues	11.40	2.60	81.43	18.57
Total Average	8.51	5.49	60.80	39.20

Of all the ergonomic considerations, the chair have the highest possible probability for the occurrence of ergonomic hazard. The probability for the chair to pose an ergonomic risk falls under Very High Probability (VHP). With an average of 87.76% answer of "No", there is the same chance that all other college faculty may experience inadequacy in the adjustable design features of chair that poses threat to risks related to the usage of chair. These data also implies the high number of college faculty that experiences musculoskeletal problems, joint pain/discomfort and other health risks affected by the usage of chair. As the risk it poses is categorized under Very High Probability (VHP), its occurrence will be continuously experienced unless action is made to change the design of the chair being used.

Most of the critical risks identified are classified as high to very high risks if assessed accordingly in the matrix. These risks may cause significant loss in the scope, quality, schedule and cost in the organization. Actions and responses must be focused on identifying and resolving these risks by lessening its chance of occurrence and minimizing its impact on the project.

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## V. CONCLUSIONS

Every day at work, we face an ergonomic hazard. Especially in tasks involving lengthy periods of stillness, repeated actions, and intense exertions. Although we rarely perform repetitive movements and intense exertions in the academe, we are nonetheless vulnerable to the dangers of ergonomic hazards caused by faulty equipment setup, improper work postures, and unsafe workplace design and environment.

The most effective way to control ergonomic hazards is to eliminate the risk factors. Sometimes you can change the tools, equipment, job design, or work area to remove the hazard completely. This is called using “engineering controls.” Improving the workplace is the heart of ergonomics: changing the work to fit the worker. The design should accommodate the wide range of people assigned to the task.

The next most effective solution is to develop workplace policies, procedures, and practices that change how the job is done. This is called using “administrative controls.” Training is a critical element of nearly any solution and provides an important opportunity for worker participation. However, it is not a substitute for reducing risk factors and should be used in combination with engineering and administrative controls.

While more permanent solutions are being found and implemented, or if you are unable to redesign the job or equipment to eliminate risks, personal protective equipment (PPE) can be used.

When actions and responses are properly implemented by the responsible parties, all risks classified under very high risk will be maintained under medium to high risk. This, reducing its chance of occurrence and impact. Problems can be avoided by good workplace design and by good working practices. Prevention is easiest if action is taken early through effective analysis of each workstation. Several practical steps can be taken to achieve an ergonomically positive environment and to promote a safer learning environment.

The following table identifies how specific aspects of our educational environment can be organized to create the right ergonomic conditions for a safer learning environment.

Ergonomic Hazards	Specific Corrective Options
Chair	<ul style="list-style-type: none"> <li>• If not and the following corrective options are not adequate, consider a new chair.</li> <li>• Adjust chair to a suitable height</li> <li>• Tilt seat for lumbar support</li> <li>• Allow adequate knee clearance under the desk</li> <li>• Do not sit in the same position for long periods</li> </ul>
Keyboard and Mouse	<ul style="list-style-type: none"> <li>• Use a wrist rest</li> <li>• Type with wrists floating above the keyboard</li> <li>• Keep elbows relaxed</li> <li>• Keep mouse at the same height as keyboard</li> <li>• Tilt the keyboard to the most comfortable position</li> </ul>
Keyboard Surface	<ul style="list-style-type: none"> <li>• Use a wrist rest</li> <li>• Type with wrists floating above the keyboard</li> <li>• Keep elbows relaxed</li> <li>• Keep mouse at the same height as keyboard</li> <li>• Tilt the keyboard to the most comfortable position</li> </ul>
Work Posture	<ul style="list-style-type: none"> <li>• Sit up straight rather than slouch forward</li> <li>• Use supports such as foot rests, wrist rests and adjustable chairs</li> <li>• Adjust equipment to the correct height, distance and angle</li> </ul>
Equipment Layout	<ul style="list-style-type: none"> <li>• Use supports such as foot rests, wrist rests and adjustable chairs</li> <li>• If using adjustable systems furniture, adjust the work surfaces down or up to achieve this positioning.</li> <li>• Use a slanted writing surface.</li> <li>• Determine if less important and less frequently used items are cluttering up the</li> </ul>

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	work surface and create space by storing them elsewhere.
Leg and Knee Room Movement	<ul style="list-style-type: none"> <li>• Remove materials underneath desk.</li> <li>• Install keyboard tray to increase distance between monitor and desktop and provide more leg room.</li> <li>• Remove clutter from underneath desk.</li> <li>• Remove any obstructions such as drawers that restrict knee space.</li> </ul>
Monitor	<ul style="list-style-type: none"> <li>• Take adequate breaks regularly</li> <li>• Adjust contrast and brightness</li> <li>• Focus on distant object regularly</li> <li>• Use an anti-glare screen with older monitors</li> <li>• Adjust height so that the top of the screen is               <ul style="list-style-type: none"> <li>• at eye level</li> </ul> </li> <li>• Position in a downwards viewing angle</li> <li>• Make sure the screen surface is clean</li> </ul>
Lighting	<ul style="list-style-type: none"> <li>• Provide natural light if possible</li> <li>• Position monitors at right angles to windows, otherwise use blinds</li> <li>• Avoid strong artificial lighting</li> </ul>
Temperature and Humidity	<ul style="list-style-type: none"> <li>• Ventilate rooms but avoid creating draughts</li> <li>• Turn off equipment when not in use</li> <li>• Consider air conditioning maintenance</li> </ul>
Work Organization and Task Issues	<ul style="list-style-type: none"> <li>• Discuss the possibility of increasing task variety with the employer and employee.</li> <li>• Optimize the workstation and equipment to allow for postural variation.</li> <li>• Encourage employee to take breaks.</li> <li>• Use headphones for software containing audio</li> </ul>

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