Rockwell Automation Team 17

Modifying Assembly Workstations for Improved Disability Support

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OBJECTIVE

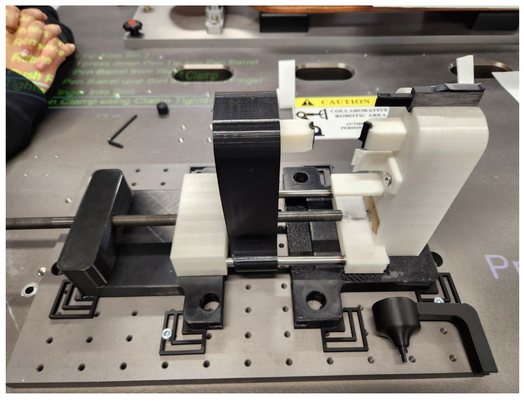
This project aims to design, develop, and implement an accessible workstation for assembling and packaging breathing pens, focused on supporting individuals with upper limb disabilities. By integrating ergonomic design, one-handed operation, and a light guide system with visual instructions, the workstation improves usability, reduces assembly errors, and enhances worker independence. The design emphasizes ease of use, precision, and safety, adhering to ISO and ANSI standards. Ultimately, the project promotes greater inclusion in manufacturing by providing practical solutions that reduce physical barriers and advance accessible technologies within Industry 4.0 initiatives.

CUSTOMER PROBLEM AND BACKGROUND

This project focuses on creating an inclusive assembly and packaging process for breathing pens, designed specifically for individuals with upper limb disabilities. Breathing pens were chosen because they require minimal manual dexterity, making them accessible to workers with limited arm or hand use. We are developing a manufacturing system built around accessibility, using disability friendly designs and automation to ensure full participation. The goal is not just to accommodate but to actively include workers with disabilities as essential contributors, setting a new standard for inclusive employment.

CONCEPTS AND EXPERIMENTATION

The first prototype had 10 major components and 2 systems. The most critical being the alignment finger and the "UFO". To test the effectiveness and usefulness of the fixture, Group 17 ran trails on 10 volunteers. The test subjects then performed 4 unique test twice. They were tested on fixtureless assembly with both hands and with only their dominant hand. The test format was then repeated with the fixture. All tests were timed and errors were tallied



REQUIREMENTS AND FINAL DESIGN

Based on the testing, Group 17 received overwhelming feedback to enlarge the area created by the "UFO" and alignment finger. Test subjects also wanted the screw to sit better. Based on that feedback, the finger was lengthened and a ramp added to help rotate the thumb screw. The "UFO" was also made taller, and a cavity added for the addition of metal to add weight. These modifications made inserting the thumb screw much easier and more ergonomic.

Method

μ_1: population mean of One Hand - Fixture
μ_2: population mean of One Hand - No Fixture
Difference: $\mu_1 - \mu_2$

Equal variances are assumed for this analysis.

Descriptive Statistics

Sample	N	Mean	StDev	SE Mean
One Hand - Fixture	23	85.9	40.7	8.5
One Hand - No Fixture	26	148	111	22

Estimation for Difference

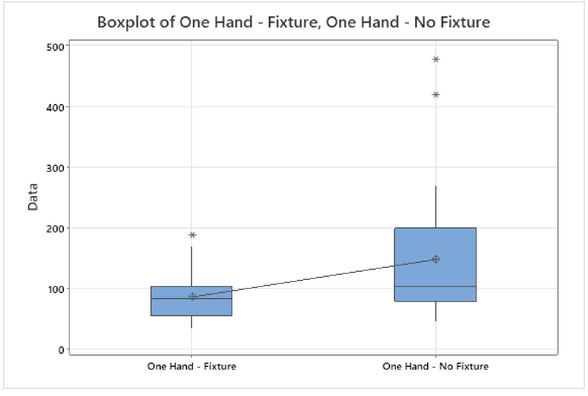
Difference	Pooled StDev	95% CI for Difference
-62.0	85.7	(-111.3, -12.7)

Test

Null hypothesis $H_0: \mu_1 - \mu_2 = 0$
Alternative hypothesis $H_1: \mu_1 - \mu_2 \neq 0$

T-Value	DF	P-Value
-2.53	47	0.015

TESTING RESULTS



CONCLUSION AND RECOMMENDATIONS

Our fixture improved assembly times when comparing assembly using one hand, with and without the fixture. Future recommendations would include a “cleaner” fixture with a catch tray underneath the finger in case the screw drops. A button to automatically move the fixture to open and close should be implemented for further ease of use.