

THE EDUEXO EDUCATIONAL EXOSKELETONS – BRINGING EXOSKELETON TECHNOLOGY INTO CLASSROOMS AND HOMES

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1. INTRODUCTION

Exoskeleton technology has gained significant attention in recent years due to its potential in various fields, including industry and rehabilitation. This increased spread and awareness of exoskeleton technology has also increased the interest in learning about and including it in an educational setting.

Recognizing the need for educational tools that make exoskeleton technology accessible, the EduExo was developed as an educational exoskeleton specifically designed to promote hands-on learning in STEM education.

The first version of the educational exoskeleton EduExo was introduced in 2017 at the WearaCon in Phenix [1]. First, details about its impact on the educational exoskeleton space have been previously reported [2].

Based on the initial learnings, further developments into a family of three educational exoskeletons have been conducted since 2017, and this abstract gives additional insight and learnings made with this evolved family of education exoskeletons.

2. MATERIALS AND METHODS

Today, the EduExo is available in three versions: the EduExo Maker, the standard EduExo in a box, and the advanced EduExo Pro Version.

All of them follow the central basic concept. They combine theoretical training through a handbook with practical experience gained assembling and programming an exoskeleton. The different versions

differentiate each other with the amount of content being taught and the complexity of the hardware provided.

2.1 The EduExo Maker

The EduExo Maker is a digital version providing a PDF handbook, 3D printing files, and a list of components to order. It is mainly intended for students and makers with access to a 3D printer, enabling them to fabricate the exoskeleton components themselves. It is made free of charge to allow anyone, independent of their budget, to access knowledge about exoskeleton technology.

2.2 The EduExo

The standard EduExo version provides a complete kit with all necessary parts, including sensors, actuators, and an instruction manual, making it suitable for educational institutions and individuals.



Figure 1: EduExo exoskeleton assembled.

2.3 The EduExo Pro

The EduExo Pro version incorporates advanced hardware to teach various exoskeleton technologies. The handbook also contains additional chapters discussing further aspects of exoskeleton development and research.



Figure 2: EduExo Pro exoskeleton assembled.

3. MAIN USE CASES

The EduExos have been implemented in various settings at home, educational institutions, and research labs. In-home and hobby environments, EduExo has allowed students and makers to explore engineering concepts and principles, encouraging creativity and problem-solving skills [3]. In schools and universities, it has been integrated into STEM curricula, enabling students to gain practical experience in robotics, biomechanics, and human-machine interaction [4]. The hands-on nature of EduExo fosters engagement, teamwork, and critical thinking among students. In research, the EduExos can be used as an adaptable platform for various exoskeleton projects.

4. RESULTS AND DISCUSSION

The EduExos present several advantages in exoskeleton education. Firstly, it provides students with a tangible and interactive learning experience, bridging the gap between theory and practice. Students can directly apply theoretical concepts by building and programming the exoskeleton, enhancing their comprehension and retention. Additionally, the availability of different versions, including the free EduExo Maker, offers accessibility to a broader audience, regardless of financial constraints.

Despite its benefits, using the different EduExos has also presented certain limitations.

The complexity of the EduExos can require additional technical support, potentially posing challenges and barriers for inexperienced users. Recognizing that EduExo users span a wide range of expertise levels, providing supplementary teaching materials, such as instructional videos, would facilitate accessibility and simplify the learning curve for novice users.

Another aspect is that by design, accessibility and the ability for the users to do all the steps by themselves with minimum tools required were prioritized over robustness. This can become a limitation in university settings, where EduExos are used extensively in classrooms or research projects. Reliability and robustness become more critical when technical problems and maintenance issues require additional resources. By engineering EduExo to withstand the demands of extensive educational use and research projects and rebalancing accessibility and robustness, its application in advanced academic pursuits can be optimized.

CONCLUSION

The various use cases have shown that the EduExo product family offers valuable tools for hands-on exoskeleton education and training, bridging the gap between theoretical knowledge and practical application. The availability of different versions caters to various user needs, including DIY enthusiasts, educational institutions, and advanced research applications.

COMPETING INTERESTS

The EduExos are commercial products sold by Auxivo AG. All authors are employed by Auxivo AG.

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