



## Wheelchairs with Portable Ramps (Waffle) Help the Daily Mobility of Students with Disabilities

Emay Mastiani<sup>1\*</sup>; Reza Febri Abadi<sup>2</sup>; Siti Nur<sup>3</sup>; Eka Yuli Astuti<sup>4</sup>; Khairil Fikri<sup>5</sup>

Universitas Islam Nusantara<sup>1,3,4,5</sup>, Universitas Sultan Ageng Tirtayasa<sup>2</sup>

\*Corresponding Author. E-mail: <sup>1</sup> [emaymastiani@uinus.ac.id](mailto:emaymastiani@uinus.ac.id)

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### Abstrak

Mahasiswa dengan disabilitas daksa kerap kali dihadapkan pada berbagai tantangan yang kompleks dan beragam dalam menjalani kehidupan kampus mereka. Tantangan-tantangan ini tidak hanya terbatas pada aspek akademik, tetapi juga mencakup berbagai aspek kehidupan sehari-hari, termasuk interaksi sosial, akses terhadap fasilitas kampus, dan partisipasi dalam berbagai kegiatan ekstrakurikuler. Salah satu aspek yang paling krusial dan sering kali menjadi hambatan besar adalah masalah mobilitas. Mobilitas merupakan kebutuhan dasar yang sangat penting, namun bagi mahasiswa disabilitas daksa, bergerak dari satu tempat ke tempat lain di lingkungan kampus sering kali menjadi tantangan yang sangat besar. Banyak gedung dan fasilitas di kampus yang tidak dirancang dengan mempertimbangkan kebutuhan aksesibilitas bagi penyandang disabilitas, sehingga mereka harus berjuang lebih keras untuk bisa berpindah tempat, menghadiri kelas, atau sekadar berpartisipasi dalam kegiatan kampus. Di sinilah muncul peran penting dari *Wheelchair with Portable Ramp* (WAFEL), sebuah inovasi yang dirancang khusus untuk membantu mengatasi masalah mobilitas ini. WAFEL menawarkan solusi yang sangat praktis dan efektif, memungkinkan mahasiswa disabilitas daksa untuk bergerak lebih leluasa dan mandiri dalam menjalani aktivitas sehari-hari di kampus. Dengan adanya WAFEL, mahasiswa disabilitas daksa tidak hanya terbantu dalam hal mobilitas, tetapi juga memperoleh kesempatan yang lebih besar untuk berpartisipasi secara penuh dalam kehidupan kampus, yang pada akhirnya dapat meningkatkan kualitas hidup dan prestasi akademik mereka.

**Kata Kunci:** Disabilitas, Kursi Roda, WAFEL, Pembelajaran, Mobilitas

### Abstract

Students with physical disabilities often face various complex and diverse challenges in living their campus life. These challenges are not only limited to academic aspects, but also cover various aspects of daily life, including social interaction, access to campus facilities, and participation in various extracurricular activities. One of the most crucial aspects and often a major obstacle is the issue of mobility. Mobility is a very important basic need, but for students with physical disabilities, moving from one place to another on campus is often a very big challenge. Many buildings and facilities on campus are not designed with accessibility needs for people with disabilities in mind, so they have to struggle harder to be able to move around, attend classes, or simply participate in campus activities. This is where the important role of the *Wheelchair with Portable Ramp* (WAFEL) comes in, an innovation specifically designed to help overcome this mobility problem. WAFEL offers a very practical and effective solution, allowing students with physical disabilities to move more freely and independently in carrying out daily activities on campus. With WAFEL, students with physical disabilities are not only helped in terms of mobility but also have greater opportunities to participate fully in campus life, which can ultimately improve their quality of life and academic achievement.

**Keywords:** Disability, Wheelchair, WAFEL, Learning, Mobility

## Introduction

This research departs from the difficulties faced by Daksas with Disabilities in carrying out daily activities both in the university environment and anywhere. The ability to easily mobility in all aspects of life is the dream of every individual, including those with special needs (Mais et al., 2021). Especially for friends with physical disabilities will be very difficult, the desire to be mobility either on campus, or in other places is highly coveted by students with disabilities. One of the mobility tools is to use a wheelchair (Desai et al., 2017). The existing wheelchair is only limited to a seat whose wheels can be moved by the hand, while to carry out other things students with physical disabilities need to change seats again, which is also very difficult. In addition, many places and streets have not adjusted accessibility to wheelchairs, even on campus, there are still many obstacles when wanting to use wheelchairs, and there is no solution until now. The purpose of this research is to carry out the Development of a Wheelchair With a Portable Ramp (Wafel) to help the daily mobility of Daksas students with disabilities in Bandung Universities.

*Wheelchair with Portable Ramp* (WAFEL) is a combination of a wheelchair with a portable ramp that is specifically designed to facilitate accessibility for wheelchair users (Arnold, 2020). This portable ramp allows students with disabilities to be more independent in moving, especially when facing obstacles such as stairs or uneven surfaces in the campus environment.

WAFEL is designed with portability in mind so that ramps can be easily carried and installed in a variety of locations. This is very important considering that not all buildings on campus are equipped with adequate accessibility for wheelchair users.

One of the main benefits of WAFEL is to increase the independence of students with disabilities (Sweeney et al., 2022). With portable ramps, they don't have to always rely on the help of others to move places. This provides a higher sense of confidence and reduces dependence on others.

Many campuses still face the problem of lack of accessibility for students with disabilities. With WAFEL, students can easily overcome physical obstacles such as stairs, high sidewalks,

or narrow doors. This allows them to be more active in academic and social activities on campus.

WAFEL also provides easy access to various campus facilities such as libraries, laboratories, and classrooms. With portable ramps, students with disabilities can access areas that were previously difficult to reach, thereby increasing their participation in the teaching and learning process.

With WAFEL, the quality of life of students with disabilities on campus can be significantly improved. They can participate more actively in campus activities without having to worry about accessibility limitations. This can also improve their academic achievement because of easier access to various educational facilities.

While WAFEL offers many benefits, some challenges need to be overcome in its implementation. One of them is the cost. The procurement of WAFEL may require a considerable initial investment, especially for campuses that have many high-rise buildings without accessibility facilities. In addition, training is also needed for students with disabilities on how to use WAFEL effectively.

## Method

Broadly speaking, this research procedure will be taken in 5 (five) stages, namely 1) Analysis: conducting an initial analysis of interviews and observations of students with disabilities about the difficulties experienced and what efforts have been made to help daily mobility, 2) Design: making a Wheelchair With Portable Ramp (WAFEL) design based on the results of the analysis 3) Development: making a Wheelchair With Portable Ramp (WAFEL) based on the results of the design and experts 4) Implementation: Limited trial regarding the use of wheelchair With Portable Ramp (WAFEL), 5) Evaluation: evaluate the use of Wheelchair With Portable Ramp (WAFEL) whose results can be used as material for improvement.

The data collection technique of this research is conducting observations, interviews, and documentation studies. This study uses the Research and Development method with the design of ADDIE (Analysis, Design, Development, Implementation, and Evaluation).

In this study, the Faculty of Teacher Training and Education (FKIP), Uninus was used as the location of the research by researchers. The model used in this study is ADDIE which includes Analysis (subject needs assessment), Design (Making a Wheelchair With Portable Ramp (WAFEL) Design, Development (making a prototype Making a Wheelchair With Portable Ramp (WAFEL) Design, Implementation (trial and implementation of Making a Wheelchair With Portable Ramp (WAFEL)), and Evaluation (Evaluating the trial and implementation to the subject). The subjects in this study are students with disabilities.

Data analysis techniques are data reduction, data presentation, and drawing conclusions or verification. The results of the Development of the Wheelchair With Portable Ramp (WAFEL) are expected to help students with disabilities in their daily mobility at Bandung Higher Education.

### Result and Discussion

The Disability Service Unit at the UNINUS Campus has been implemented with Decree Number 226/UNINUS. R/SU/TA/2022 under the name of the Center for Special Needs Studies and Services (PSLKK). However, in its implementation, it still needs to be supported, including supporting infrastructure, many buildings on campus have not supported accessibility for students with disabilities, so developing a Wheelchair With a Portable Ramp (WAFEL) in Assist the Daily Mobility of Daksa Students with Disabilities at Bandung Higher Education as a solution, based on data collection carried out by previous researchers :

Table 1. Wheelchair User Request

User Request	% Number of Respondents
Wheelchair (Consumer)	74
Flexible	55
Comfortable	62
Can be used for sleep	79
Can be used for learning	75
Strong	30
Can enter the toilet	45
Automatic	35
Light	

Based on these results, the concept of the wheelchair to be developed, following consumer demands has been translated into technical requirements, such as flexible mechanisms and comfort, automatic control through the control rod, and DC motor as a source of drive (power). Because guides are still needed, especially for

wheelchair users with Cerebral Palsy (CP), wheelchairs must still be equipped with handles for pushers (guides) with a standard shape. To help the wheelchair user's leg position when sitting, the wheelchair is also equipped with a footrest, the wheelchair must also be able to provide a place to study, to the toilet flexible but still strong.

### Designing Wheelchair Components

#### Wheelchair Dimensions

The frame is the most important part of the wheelchair to be designed. This is because the shape, size, and model of the frame will be able to develop various other components. Because wheelchairs will be used by humans in certain activities, the design must meet standards, namely comfort and following the wearer's body size (Andrijanto & Hutapea, 2019). (Ziegler, 2003) (Ziegler, 2003).

#### Wheelchair Frame Strength Analysis

The frame material used in the manufacture of this wheelchair is a St 37 tube with a diameter of 20 mm. Analysis of the strength of the frame is carried out so that the wheelchair used is suitable, and the stasis loading is 150 kg (Kumtepe et al., 2020).

#### Body Injury Risk Analysis

Analyze the comfort (ergonomic) of wheelchair users in the condition of the up-down seating. This analysis is used to determine the maximum distance to raise the wheelchair seat, where the wheelchair user's hand can still move the handbrake (Kholis et al., 2022).

Furthermore, the experts needed in this study include:

Technician (3 people)

Because of the development of the Wheelchair With Portable Ramp (WAFEL), assistance is needed to make wheelchairs.

Design Expert (1 Person)

The Design Expert will help with ergonomic work that suits the subject's needs.


#### Success indicators

Researchers have determined the success indicators of the development of the use of Disability-Inclusive Wheelchairs (KRIS) in students with disabilities in universities. These indicators include:

Table 2. Success Indicators

3	2	1
If Wheelchair With Portable	If the Wheelchair With Portable	If Wheelchair With Portable

Ramp (WAFEL) in Helping the Daily Mobility of Daksa Students with Disabilities at Bandung Higher Education is Successful developed and functional/usable	Ramp (WAFEL) in Assisting the Daily Mobility of Daksa Students with Disabilities at Bandung Universities is successfully developed but it doesn't work/can't be used	Ramp (WAFEL) in Assisting the Daily Mobility of Daksa Students with Disabilities at Bandung Universities fails / fails to be developed
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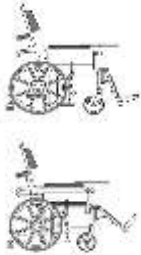




6		metal provides reliable use. The handle and bar are made of aluminum bars.
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The table above has been validated by expert Dr. Hj. Dede N Dede Khoeriah, M.A. with the following results:

Table 4. Product Validation

No.	Ergonomic Aspects	Other aspects	Benefit
1	Effectiveness	Maintenance  Raw materials	Easy to clean Easy to carry  The material is lightweight
2	Security	Risk	For safety there is clarity regarding the dimensions (length and size of height, and width) of the stair ramp compared to the wheelchair Make sure there are no sharp corners, not slippery, the product is safe and sturdy
3	Comfort	Size and material	Adapted to the user's size Doesn't make you tired
3	Health	Precise dimensions	Wheelchair according to posture
4	Efficiency	Functional	Easy to operate (Note: Cerebral

The design of the learning media developed is as follows :

Table 3. Learning media design Stages	Picture	Picture
1		Easy operation: People in need can drive the vehicle by hand after enough practice, to control the accelerator pedal and the push handle to control the brake pedal.
2		Design: No need for stepless assembly,
3		installation and adjustment by using one allen wrench, most users can find a comfortable position for themselves.
4		Universality: with the pedal organ or suspension both apply, it can be used on So it applies to most vehicles.
5		Quality & Durability: Thick

			Palsy users need convenience through the use of buttons)
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### **The Impact of Wheelchairs with Portable Ramps on Daily Mobility for Students with Disabilities**

Access to education is a fundamental right for all individuals. However, for students with disabilities, barriers to mobility within educational settings can hinder their ability to fully participate in academic and social activities. Wheelchairs equipped with portable ramps have emerged as a transformative solution, enabling greater autonomy and mobility for these students (Carver et al., 2016). The author will explore how these adaptive tools not only enhance daily mobility but also empower students with disabilities to thrive in their educational environments.

#### **Enhancing Accessibility**

One of the primary benefits of wheelchairs with portable ramps is the significant improvement in accessibility. Traditional environments often present challenges, such as stairs and uneven surfaces, that can prevent students from navigating their surroundings effectively (Kapsalis et al., 2024). Portable ramps act as a bridge, allowing for seamless transitions over physical obstacles. These ramps can be easily deployed in various settings—classrooms, hallways, and outdoor spaces—thereby promoting inclusivity and equal participation.

The incorporation of portable ramps also reflects a growing recognition of diverse needs within educational institutions (Østensjø et al., 2005). Campuses that prioritize adaptive technology foster an environment where all students feel valued and supported. Consequently, the use of these devices not only addresses physical mobility challenges but also contributes to a more inclusive school culture.

#### **Promoting Independence**

The ability of students with disabilities to move freely and independently cannot be overstated. Wheelchairs with portable ramps provide students with greater control over their movements, facilitating a sense of personal agency and self-reliance. This independence is particularly crucial during transitions between

classes, group activities, and extracurricular events, where students often encounter varying degrees of accessibility (Kumtepe et al., 2021). Moreover, by enabling students to navigate their environments independently, portable ramps help to reduce reliance on aides or peers for support. This independence fosters confidence and encourages students to engage more fully with their peers. Social interactions—an essential component of the educational experience—can be significantly enriched when students feel empowered to take part in all aspects of school life.

#### **Fostering Social Inclusion**

Social inclusion is a key aspect of a holistic educational experience. When students with disabilities are provided with the tools they need to navigate their environments, they are more likely to form connections and friendships with their peers (Coleman et al., 2015). Wheelchairs with portable ramps catalyze fostering these relationships, as they allow for increased participation in group activities and collaborative projects. Moreover, the visibility of students using adaptable devices can promote awareness and understanding among their peers. This can help to dismantle stereotypes and misconceptions about disabilities, fostering a more empathetic and inclusive school community (Scheffers et al., 2021). As students interact with one another, they learn invaluable lessons about diversity and adaptability—lessons that extend beyond the classroom.

#### **Challenges and the Path Forward**

While wheelchairs with portable ramps offer substantial benefits, it is essential to acknowledge the challenges that can arise in their implementation. The cost of adaptive devices, proper training for staff, and ongoing maintenance can pose barriers to some educational institutions. However, these challenges should not deter stakeholders from pursuing solutions. Campuses can work collaboratively with communities, advocacy groups, and funding organizations to ensure that resources are allocated effectively (Routhier et al., 2019). Encouragingly, there is a growing awareness of the importance of mobility solutions in education. As society becomes more attuned to the needs of individuals with disabilities, Campuses must stay proactive in implementing adaptive technologies (Bills, 2017). By prioritizing accessibility and mobility, educational institutions can play a pivotal role in fostering an inclusive environment.

In conclusion, wheelchairs equipped with portable ramps significantly enhance the daily mobility of students with disabilities, allowing them to navigate their educational environments with greater ease and independence. These devices not only serve a practical purpose but also embody a commitment to inclusivity and empowerment. By addressing barriers to accessibility, Campuses can foster social inclusion and cultivate an environment where every student has the opportunity to thrive. The path forward may include challenges, but the collective effort to prioritize adaptive technologies is undeniably worthwhile. Together, we can build a future where all students, regardless of their physical abilities, are afforded equal opportunities for success.

## Conclusion

Wheelchair with Portable Ramp (WAFEL) is a very significant innovation and has a great positive impact on the daily mobility of students with disabilities. WAFEL not only makes it easier for students to get around the campus but also increases their independence so that they can be more active and fully participate in various aspects of academic and social life on campus. With WAFEL, physical barriers that have been a major barrier for students with disabilities can be overcome more effectively, providing them with better access to various educational facilities that were previously difficult to reach.

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However, it is important to recognize that the implementation of WAFEL on campus is not free from challenges. One of the main challenges is the cost of procurement and maintenance of these devices, as well as the need for training for students and campus staff to use WAFEL optimally. In addition, there are challenges in terms of adjusting campus infrastructure to support the wider use of WAFEL. Even so, with careful planning and commitment from the university, these challenges can be overcome.

As a solution, universities may consider looking for alternative sources of funding, such as grants or sponsorships, to support the procurement of WAFEL. In addition, training on the use of WAFEL can be integrated into orientation programs for new students with disabilities. The university can also evaluate the campus infrastructure to ensure that the physical environment of the campus is truly inclusive and supports the mobility needs of all students, including those who use WAFEL.

The long-term benefits offered by WAFEL make it a solution that is not only worth considering, but should also be prioritized by any educational institution that cares about inclusion, well-being, and equality of opportunity for all its students. Thus, WAFEL is not only a mobility aid, but also a symbol of the university's commitment to creating a truly inclusive and accessible educational environment for all.

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