Design computer laboratory friendly for disabilities

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Abstract. The purpose of this study is as a preliminary study to determine the availability of computer laboratory facilities and computer laboratory designs available at vocational high schools whether they have understood the students with physical disabilities, then from the findings obtained will be made a computer laboratory building design that is friendly to students with disabilities. Data collection uses observation and semi-structured interviews. The researcher interviewed several teachers in vocational high schools to explore information about the availability of facilities and supporting infrastructure in schools for people with physical disabilities especially in computer laboratories. The researcher also interviewed two special school teachers to explore information about the needs of facilities and infrastructure for people with physical disabilities, their experiences while observing and doing activities with students with disabilities. The results of this study indicate the unavailability of friendly infrastructure facilities for people with disabilities, especially computer laboratories in vocational high schools, also found several barriers and expectations about the future design of computer laboratories. The conclusion from this study recommends that schools make improvements and additions to facilities that support students with disabilities, especially those who have physical disabilities, so that they can carry out activities like normal students when accessing facilities and infrastructure at school.

1. Introduction
Today, one in eight people in the world lives with a physical or mental disability [1]. So that schools need change to provide appropriate education for all students, these changes must be based on a multi-level approach that challenges structural, cultural and individual conditions that create, perpetuate and legitimize disablism [2]. The limited assistance facilities for students with disabilities so that they need more helpful facilities along with raising awareness about these facilities, so that the assistance facilities can help learning and make students with disabilities more comfortable, so that the disability register must be open to students at school [3]. Besides the design and development of the environment must pay attention to the needs of people with disabilities, so far the design and development of the environment does not pay attention to the needs of people with disabilities [4].

An important laboratory for technical education [5]. Computer laboratories are one of the most challenging aspects when providing practical tasks related to the improvement of educational technology [6]. Students' motivation and expectations for academic progress can be influenced by the operation and status of computers in the laboratory [7]. At least one computer laboratory containing 20 to 24 computers must be owned by schools that accept 60 new students per year [8]. So that a good
computer laboratory should have good and appropriate facilities to support the teaching and learning process.

Problems arise in computer laboratories that have been built with inappropriate designs in schools. Poor buildings tend to endanger the health of the occupants while negatively affecting productivity levels [9]. For people with disabilities using a wheelchair will be difficult if the building is not built friendly to people with disabilities such as when accessing building facilities and outdoor mobility [10]. The main obstacle for physical impairment users is related to the quality of the trail [11]. Therefore buildings need to provide a more inclusive environment that meets the needs of broader users, especially people with disabilities. Furthermore improper air exchange management results in low indoor air quality in computer laboratories [12]. Although passive cooling techniques such as ventilation and ceiling fans, can contribute significantly to reducing heat temperatures [13]. Computer layouts in laboratories for academic staff prefer to use computer laboratories designed throughout the more traditional lecture room layout when working with new students although computer layout students do not influence students to choose and use computers to be used [14].

2. Methods
This research was conducted at vocational high schools and special schools on the coast of Riau. Data collection uses observation methods and semi-structural interviews. The school facilities reviewed were observed in this study, namely parking lots, pedestrian walkways, entrances of computer laboratory rooms, layout of tables and chairs, area of computer laboratory rooms, corridors and interior lines, drainage facilities, building signs and washrooms and lighting and computer laboratory room temperature. In addition, the researchers conducted semi-structured interviews with several teachers from special schools regarding their experiences in teaching and activities with students with physical disabilities, furthermore their experiences of the infrastructure available to support the teaching and learning process in schools and the obstacles they observed from students, with physical disruption when doing activities to access facilities and infrastructure available at school. Furthermore, researchers also conducted semi-structural interviews via telephone to a number of high school vocational teachers to find out their responses and information about the facilities available at each school, especially computer laboratories. In more detail the informants in this study are shown in the table 1 as follows.

| Informant | Sex | Age    | Teaching experience | Official                  |
|-----------|-----|--------|---------------------|--------------------------|
| informant1 | Male | 37 years old | 10 years           | special school            |
| informant2 | Male | 31 years old | 5 years            | special school            |
| informant3 | Male | 37 years old | 8 years            | Vocational high School    |
| informant4 | Male | 39 years old | 10 years           | Vocational high School    |
| informant5 | female | 31 years old | 5 years            | Vocational high School    |
| informant6 | female | 32 years old | 8 years            | Vocational high School    |

These questions relate to the computer laboratory buildings available in vocational secondary schools such as the area of the laboratory room, the maximum amount of student capacity when carrying out the learning process in the laboratory, computer facilities available, room temperature, lighting, equipment room, laboratory headroom, access bathroom with a laboratory room, constraints experienced due to buildings that are felt lacking and facilities that should be available at a computer laboratory. Next the researchers asked their experience of whether or not teaching students who had physical disabilities.

3. Results and discussion
From the observations during the extraordinary school observation to explore the information of facilities available for students with disabilities, especially physical impairments that will later be applied in the design of computer laboratories at vocational secondary schools, the researchers were surprised to find that facilities such as pedestrian corridors still have floors with significant elevation
differences. Certainly a barrier for the mobility of people with physical disabilities especially those who use wheelchairs to carry out their activities, at the entrance to the study room there are barriers in the form of a barrier, drainage is not closed, building signs for disability are also lacking, bathroom access is also seen between the floor and the bathroom entrance also has a barrier and uses a squat closet.

In detail, the facilities felt to be a barrier for people with disabilities in carrying out activities in the school building are listed as follows in Figure 1 and Figure 2.

![Figure 1](image1.png)  
**Figure 1.** (a) corridor; (b) study room door; (c) drainage channel.

- Corridor floors between buildings that have significant elevation
- The entrance to the room that has obstacles
- Open drainage can be a barrier for people with disabilities to carry out activities

![Figure 2](image2.png)  
**Figure 2.** (a) squat closet; (b) toilet entrance; (c) place of ablution.
• Use the squat closet in the bathroom
• Bathroom entrances with obstacles
• Ablution places with different floor elevations and with open drainage channels

The results of interviews with special school teachers researchers found information that this school building is an old building so that the actual building design was not designed specifically for students with disabilities where the school building was built with school building designs in general so that it was not friendly for people with disabilities, furthermore or the bulkhead at the entrance to both the study room and the bathroom is made because of natural factors where in the rainy season the water will stagnate and enter the room so a solution is made to make a barrier at the entrance of the room.

The results of interviews with senior high school teachers' researchers found that the secondary vocational schools did not yet have facilities to support students with disabilities. In particular, there are computer laboratories that even use regular classrooms that are used as computer labs, less space to accommodate the maximum number of students for a class, hot temperatures due to lack of education, lighting that is felt to be insufficient because of the need to turn on the lights during the learning process teaching takes place in a computer laboratory, a bathroom that is not integrated with the laboratory building so that the bathroom requires fairly remote access.

To overcome barriers and improve environmental conditions that are not appropriate, especially for travel accessibility with different floor elevation obstacles as described in the paragraph above, it is better for the authorities in this case the school to make additional ramps for both pedestrian access and at the entrance to the room while for Drainage channels These problems can be overcome by making a cover for the drainage channel.

4. Conclusions

Computer laboratory is one of the supporting facilities for the teaching and learning process, especially for technical education. The design of computer laboratories should pay attention to the needs of people with disabilities, where 12.5% of people in the world live with physical or mental disabilities so that people with disabilities are not neglected in getting education so schools need to make changes to provide appropriate education for all students, who create, perpetuate and legitimize disablism. The reality that is experienced at this time is that public school buildings such as vocational high schools do not yet provide facilities for people with disabilities so improvements to school infrastructure can provide facilities that are friendly to people with disabilities so students with disabilities, especially physical disabilities, can go to public schools which certainly have diverse arrangements compared to extraordinary schools so that students' interests and talents can be channeled.

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