

## **Accessibility of Family and Consumer Sciences Laboratories in Botswana Junior Secondary Schools by Learners with Physical Disabilities**

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*During the past decade, significant progress has been made on how to accommodate and teach learners with disabilities. However, less research has been done on creating a conducive learning environment for learners with disabilities. The purpose of this study was to determine the accessibility of Family and Consumer Sciences (FCS) laboratories for learners with mobility problems. The focus of this study was on the accessibility, reach ability, and safety of FCS laboratories. Fifty junior secondary schools in the South Central Region of Botswana were selected for the study. A questionnaire and an accessibility checklist were used to evaluate the laboratories' current situation. The findings indicate that all FCS laboratories investigated were not designed to meet the needs of learners with mobility disabilities.*

Until recently, physically challenged learners were not accommodated in the design of physical environments. In education, the concentration has been on curriculum instruction and teaching learners with special needs such as visual, hearing, mental and physical disabilities. Less emphasis has been placed on the learning environment necessary for their everyday learning activities. Previous studies mainly investigated the general accessibility of the school environment and less on specific school environments such as classrooms and laboratories. The learning environment has been mainly designed for able bodied learners, making it inaccessible to the physically challenged users (Lifchez, 1983). The design of educational spaces that are accessible to learners with disabilities will encourage the entry of these learners into mainstream schools without isolating them in special schools.

For the purpose of this study, the term "physical disability" was defined as limited in mobility, strength and reach ability, and also confined to wheelchair, especially if the lower part of the body is affected (Rostron & Fordham, 1996). The objective of the study was to highlight the importance of creating safe, usable and comfortable Family and Consumer Science (FCS) laboratories that encourage a supportive environment to promote independent learning for learners with physical disabilities. The study aimed to answer the following research questions.

1. Are the laboratories designed to accommodate learners with physical disabilities in terms of accessibility, reach ability, usability, and safety?
2. Are there special/adapted areas designed and arranged for learners with physical disabilities?
3. Are learners with physical disabilities able to easily access facilities such as equipment, appliances, furniture, storeroom, safety appliances, and electrical outlets?
4. Is the circulation space in the laboratories adequate for learners with mobility challenges?

## Background

### *Botswana Education*

Botswana is a landlocked country in Southern Africa. Botswana's economic and political stability has made a huge positive impact on its education system. Until recently, the government provided ten years of basic education free to every Botswana child who enrolled in public schools; however, a cost recovery system was instituted in 2008 whereby learners whose parents and/or guardians are capable of meeting tuition costs are now required to do so. Both boys and girls have equal access to education. The formal education system consists of seven years of primary, three years junior secondary and two years of senior secondary school before learners can be admitted into tertiary institutions (United Nations, 2002).

In Botswana, the need to educate children with disabilities was not a priority to the government until recently. In 1969, the first school for children with disabilities was established by the missionaries of the Dutch Reformed Church catering mainly to learners with visual disabilities. In the 1970's, more schools were developed by non-governmental organizations (NGOs). At the same time, the government carried out studies on different disabilities to analyze the situation in the country. The first step in recognizing the need to educate those with disabilities came in 1984 when the Ministry of Education established a Special Education Unit, later known as the Special Education Division. The aim of the division was to provide policy leadership and direction in special education, training special education personnel and providing resources (Abosi & Mukunga, 1996).

Since the commissioning of this division by the government, several ministries have responded to the need to provide services to people with special needs. The Ministry of Health introduced the Special Services Unit for the Handicapped in 1975, later known as Rehabilitation Services Division. The Ministry of Local Government also responded by establishing the Department of Social Welfare and Community Services. The National Policy on Care for People with Disabilities was approved and adopted by the government of Botswana in 1996 (Ministry of Health, 1996).

In 1997, the government of Botswana set specific goals to guide the operational mission and goals of all the different governmental, non-governmental organizations and parastatals known as *Vision 2016: Long Term Vision for Botswana -Towards Prosperity for All* with seven vision pillars. The pillars were later aligned with the United Nation's Millennium Development Goals (MDGs). The seven pillars include: an educated, informed nation; a prosperous, productive, and innovative nation; a compassionate, just and caring nation; a safe and secure nation; an open, democratic and accountable nation; a moral and tolerant nation; and a united and proud nation. Education is addressed under Vision Pillar 1(Presidential Task Force, 1997) as:

All Botswana must have the opportunity for continued and universal education, with options after 'O' level to take up vocational or technical training as an alternative to purely academic study. Education must be developed in partnership between the public and private sectors.

According to the long-term vision for Botswana - *Vision 2016*, all Botswana citizens will have an opportunity to education and this include people with disabilities. The vision states that education must include those with disabilities for them to be functional and productive members of society. Botswana hopes to achieve a nation that is compassionate, just and caring towards vulnerable groups. This, among other things, includes providing user-friendly environments for people with disabilities (Presidential Task Force, 1997).

### *Family and Consumer Sciences (FCS) in Secondary Schools*

The Botswana secondary school system offers a variety of subjects, including FCS, which is still known as Home Economics. Both boys and girls are free to choose FCS as one of their practical subjects. In junior secondary schools, FCS is offered as a single subject with several components. The components are textile and clothing, food and nutrition, and home

management and are normally taught in one laboratory. In senior secondary schools, it is offered as three separate subject areas. Those separate subject areas are fashion and fabrics, food and nutrition, and home management with each area taught in its specialty laboratory. The Ministry of Education and Skills Development through the Department of Curriculum Development and Education is responsible for what is to be taught in schools. The FCS curriculum is centralized and developed by a panel of teachers, education officers, examination council officers and other stakeholders.

The government, through the Ministry of Education, provides facilities for teaching and learning of FCS in all secondary schools. FCS is a valued subject viewed as providing learners with knowledge, understanding, skills, and attitudes necessary for managing their own lives. A recently launched junior secondary FCS syllabus stresses the need to create and provide learning environment accessible to all learners regardless of gender, color, race, disability, or any other physical and emotional conditions (Ministry of Education, 2008). The question is whether the laboratories cater to all educators and learners with physical disabilities, hence the study. Lack of access to facilities can affect the enrollment, teaching, and learning of the subject, resulting in failure to achieve its basic aims.

## Review of Literature

### *Accessible Physical Environment*

Majority of developed and developing countries have come up with legislations, which prohibit discrimination based on disability in all institutions and industries. As a result, inclusion of learners with disabilities in the mainstream educational environment has been targeted over the years, although different terminologies are used including integrated education and special education among others. Since the 1970s, Swedish International Development Cooperation Agency (SIDA) has supported inclusive education programs in countries like Botswana, Zimbabwe, Zambia, South Africa, Sri Lanka, Portugal, and Tanzania. Although there is a lot of support for the inclusive education system, it has been observed that very few countries have managed to successfully implement the idea (SIDA, 2003). Historically, most learners with physical and mental disabilities were excluded from public schools. Schools with programs and facilities to serve children with disabilities tended to be centralized and segregated. In most cases, this resulted in ill-equipped and generally unprepared public schools to accommodate and educate learners with disabilities (Ainsley, 2000). Only a handful of research work has been done to investigate the impact of the physical environment to the learning and normal school activities of learners with physical disabilities.

An accurate understanding of barrier removal in a broader context is very important; it should extend beyond access to toilets and ramps. According to Rostron and Fordham (1996), the general problem that hinders creating an accessible environment is the tendency to underestimate the abilities of people with disabilities. It is important to understand that people with disabilities are only disabled in terms of their specific impairment. Rostron and Fordham indicate that design of the physical environment for people with disabilities will help them throughout the life cycle and lessen the need for redesigning, especially in later years. This setting should provide the user with a sense of achievement and independence depending on their needs. It should be more usable, comfortable and take less time and energy to maintain. It is also important to design and select furnishings and equipment that will heighten abilities and reinforce competencies in the performance of independent daily activities.

Developed nations such as the United States have created national policies that protect their citizens, which extend to people with disabilities. One of these laws is the Americans with Disability Act (ADA) of 1990, which is a civil rights legislation that disallows discrimination to people with disabilities. The act outlines the requirements for accessible design of public places and facilities for all people, making buildings and facilities easily accessible to people with

disabilities (Stoecklin, 2008; U.S. Architectural and Transportation Barriers Compliance Board, 1990).

#### *Accessibility of School Buildings and Facilities*

A qualitative study carried out by Prellwitz and Tamm (2000) investigated how Swedish learners with restricted mobility aged 7-12 years perceived the accessibility of their school environment. Their study revealed that despite the general satisfaction with the physical environment, learners still experienced challenges with learning, playing and/or socializing with others. The design of the physical environment reduced opportunities for learners with restricted mobility to be in contact with other learners, especially in places such as the playgrounds. Learners in wheelchairs experienced problems with maneuvering their wheelchairs and were dependent on others for assistance. This problem was made even more difficult by the learners' school bags placed on the floors and chairs around the classrooms. They also had difficulties reaching for the chalkboard and books as they were placed high. Learners in wheelchairs used lifts to reach places on another level such as the dining hall, but also needed further assistance.

Accessibility of the toilets was another challenge because they were too small. Toilets that were large enough to be used by persons with disabilities were placed further away or on another floor. Learners did not perceive the use of corridors as a problem except for some heavy doors. In the classrooms, learners were provided with adapted chairs, which they perceived as a major challenge compared to moving around because it was difficult to get in and out of them. The adapted chairs also hindered them from interacting with other learners and participating in group activities (Prellwitz & Tamm, 2000).

In another Swedish study by Hemmingson and Borell (2002) that highlighted the experiences of learners with physical disabilities in mainstream schools, most of the learners were found to experience barrier challenges in both the physical and the social environments. The main physical environment barriers in their schools which hindered their performance were lack of automatic door openers, ramps, elevators, suitable desks, chairs, and assistive devices. Due to these barriers, transferring from one classroom or level to another brought more challenges to the learners with physical disabilities. Most of the learners had difficulties in performing activities such as handicrafts, sports, or many outdoor activities. This constraint resulted in students being restricted or excluded from some of the school activities. In the social environment, these barriers were mainly from how learning activities were organized, but not from the level of their physical ability. The study concluded by emphasizing the importance of making flexible and appropriate adaptations to meet the physical, educational and social needs of learners with physical disabilities.

West, Kregel, Getzel, Ming, Ipsen, and Martin (1993) carried out a similar study in Virginia to investigate the level of satisfaction of accessibility by learners with disabilities in colleges and universities. Their survey found out that learners were happy with most services and accommodations as well as special equipment provided in the classrooms. However, the students with disabilities still encountered architectural barriers creating accessibility problems to some facilities. These included lack of an elevator, accessible entrances that were located far away, and laboratory spaces that were inaccessible, such as computer laboratories. Other barriers included ramps that were difficult to use and handicapped parking that was not appropriately placed by the main entrance. Some of the challenges included lack of understanding and cooperation from administrators, faculty and other learners and little involvement in modifying spaces.

Paul (1999) also carried out a study in United States of America to determine life experiences of learners in wheelchairs in a large urban university. Paul found some learners made choices of their university on the basis of services available and the accessibility of the school. The participants strongly emphasized the importance of getting educated without any physical barriers. The better physical environment, accommodations and facilities within the

university played an important role in how the learners integrated and related with the university atmosphere.

In a study by Pivik, McComas, and Laflamme (2002), a focus group of 15 learners with restricted mobility and 12 parents were asked to identify barriers at their schools. The findings indicated the facilitators and barriers to accessibility of eight schools in Ontario, Canada. The environmental barriers reported by the learners, included stairs and ramps, elevators, lockers, doors, water fountains, recreational areas, and washrooms. Learners reported physically getting into school as the main challenge because of few doors with ramps. They identified the doors as not wide enough, too heavy and most did not have automatic door buttons. This raised concerns of being trapped if there was fire. Other barriers included little space between desks, narrow and crowded passageways, lockers that were not reachable, inaccessible washrooms, and difficulty reaching other floors using an elevator, which is a barrier during fire and fire drills. The learners suggested technological and architectural solutions for the environmental barriers, to include wider and automatic doors, motion sensors on toilets and faucets, lowering locker shelves and hooks, wider passageways and space between classroom furniture, and installing more gradual inclined ramps.

### *The Learning Environment*

The teaching and learning environment contributes a lot towards the success of the teaching and learning process. Farrant (1996) pointed out that under favorable learning conditions most learners learn more and this includes learners with physical disabilities. Chamberlain (2003) pointed out that the accessibility of available spaces and equipment affect the teaching/learning activities that can be carried out. A study carried out by Mberengwa and Silo (2005) on management of instruction in FCS laboratories revealed that the laboratories in Botswana's junior secondary schools were generally small and crowded. They raised concern that a scenario like this poses a challenge in the laboratories if a student with physical disability happens to be enrolled in FCS.

Neely (2007) carried out a study to examine accessibility of science labs in accommodating learners with physical and visual impairments on general lab tasks in two higher education institutions in Colorado Springs. The subjects of the study included 15 learners with varied disabilities. It was found that learners in wheelchairs had difficulties in maneuvering their wheelchairs around stools, benches, and chairs in the lab. The benches were too high and had no knee space. Access to some of the equipment in the lab was also difficult creating safety concerns. In addressing the concerns, Neely suggested the use of easy to reach sink faucets, gas, and power connections for wheelchair users. Learners with vision disabilities benefited from larger dots that showed low to high temperatures, Braille label markers to label on and off switches, digital readouts, and high contrast backgrounds. Neely, however, indicated that differences between lower and upper body disabilities must be considered in determining the challenges and modification of the learners. A single change might not be appropriate to meet the challenges of all learners with disabilities.

Bargerhuff, Kirch, and Wheatly (2004) discussed the CLASS (Creating Laboratory Access for Science Students) project undertaken by Wright State University in Ohio to accommodate learners with disabilities in the science subject from middle school to university. The aim of the project was to adapt the traditional science lab to an adaptive lab that promotes active involvement of learners with single and multiple disabilities. This project would also improve teacher preparedness in teaching science to learners with disabilities by creating a more inclusive learning environment.

In conclusion, most of the previous research studies have supported inclusive education. The studies concur that learners with disabilities must be placed in general education classrooms with proper facilities to support their learning. However, for successful inclusion to occur, proper supports of comparable quality should be in place. Despite the effort by most countries to include

learners with disabilities in regular school, the findings indicate that a lot of the school facilities are still not accessible and user friendly to them.

## **Methodology**

### ***Sample and Sampling Procedure***

A total of 55 junior secondary schools were initially included in the study pertaining to accessibility of FCS laboratories by learners with mobility problems. The 55 schools in the South Central Region, which included Gaborone, the capital city of Botswana, and its surrounding villages, were obtained from the Ministry of Education. The study was limited to government owned (public schools) junior secondary schools for their enrollment policy of accommodating all children regardless of their physical ability. From the 55 junior secondary schools in the South Central Region, only 50 were reachable to the researchers while five could not be reached due to bad roads and other technicalities. Hence, 50 schools were included in the sample for this study.

### ***Instruments***

Two instruments, a questionnaire and an observation checklist, were used to collect data. The questionnaire was completed by the schools' administrators (schools' principals or schools' deputy principals) to collect demographic and general information about the learners and teachers. The questionnaire consisted of closed-ended questions and one open-ended question that covered the type of teachers' and learners' disabilities in the schools, presence of learners with disabilities enrolled in FCS and how they were assisted. It was also determined whether the laboratories had ever been renovated to accommodate staff and learners with disabilities. Informal interviews were conducted with the schools' principals and the FCS teachers during data collection to clarify responses and share challenges they experience.

An accessibility observation checklist was used as an instrument to observe and assess the interior spaces of the FCS laboratories by means of accessibility and reachability of the entrance, equipment, teaching and cooking areas, flooring, and lighting of the laboratories. The checklist was divided into the following four categories: entrance, teaching area, kitchen and store room area, and circulation. The entrance section had seven items, which included availability of a ramp and handrails, accessibility without having to use stairs or steps, height of door handles, space to maneuver a wheelchair at the entrance (width of door), and slip resistance of the floor surface. The teaching area, with five items, was assessed for heights of the tables from a wheelchair position, free flow and maneuvers of a wheelchair around laboratory furniture, reachability of chalkboard from a seated position, and any obstructions and protrusions from floor or walls.

Assessment of the kitchen/cooking and store room area had 12 items, which included accessibility of electrical switches, electrical outlets and cooker controls, counter and sink height, knee space under counter and sink, reachability of shelves from seated positions, types of taps (lever on non lever type), space to maneuver the wheelchair, availability and reachability of the fire extinguisher, and availability of pull-out storage units. Circulation section had three components consisting of corridors (four items), stairs (six items), and ramps (five items). Assessment of circulation included width of corridors, accessibility of ramps and stairs, and lighting visibility around the laboratory. The checklist was completed by the researchers based on their observations during their visits to the schools.

### ***Data Collection***

Following official clearance from the Ministry of Education and Skills Development, data was collected from 50 junior secondary schools in the South Central Region. During data collection, only 49 schools had their laboratories surveyed because the FCS laboratory in one school was burnt down during a cooking lesson. The authors decided to include the school with

the burnt laboratory in the study as missing to bring out the concerns of safety issues, making a total of 50 schools. The direct observations of the FCS laboratories were done by the researchers, with the assistance of the FCS teachers, using the checklist. Direct observations had an advantage of providing the researchers with the opportunity to investigate exactly what was in place. Informal interviews were conducted during observations with FCS teachers and administrators to explain and verify any emerging issues that could be incorporated as additional information.

Administrators were given self-administered questionnaires to complete while the researchers were conducting their observations. In cases where administrators were not immediately available, the questionnaires were left with the schools to be later collected. From 50 schools, five school administrators did not return the questionnaires despite giving the researchers permission to conduct the observations. Efforts to obtain the remaining questionnaires were not fruitful, thereby yielding 45 useable questionnaires for the study.

#### *Data analysis*

Quantitative analyses were performed to determine the type of disabilities in schools and general accessibility of the FCS laboratories and equipment. The open question was closed and post-coded for quantitative analysis. Data was analyzed using SPSS computer software (version 14.0 for Windows). Descriptive statistics were employed in summarizing data. Results from quantitative analysis are presented in frequency tables, pie charts and graphs.

#### **Findings**

The analysis of the data gives an overview on types of disabilities found among teachers and learners in junior schools. The findings indicated that there are some learners with physical disabilities in mainstream schools. The results also outline accessibility of main entrance, learning and cooking areas of FCS laboratories in junior schools in relation to circulation, reachability, and safety.

#### *Types of Disabilities among Teachers*

Although the study results in Figure 1 indicate that most of the teachers (77%) have no disability of any kind the analysis, however, revealed that a significant proportion of the teachers (23%) had some form of disability. The common disabilities reported (Figure 1) are physical disability with the use of crutches (13%); this was followed by physical disability affecting use of hands (6%). Only 2% of the teachers were wheelchair users, and the other 2% represented those with hearing and vision impairment.

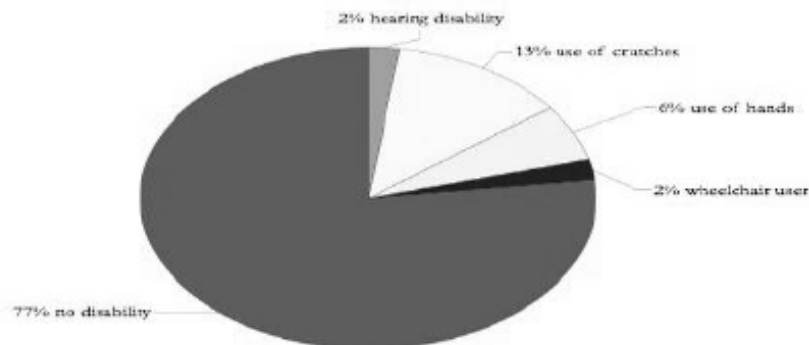


Figure 1. Types of Disabilities for Teachers.

As displayed in Figure 2, administrators in some schools reported different types of disabilities, which were found among junior school age learners. The results revealed that the common disabilities among learners are speech and mental impairments (14%), followed by hearing impairment (12%). Only 10% of the learners had a physical disability with use of crutches and 5% were wheelchair users. Incidentally, Mukamaambo, Shaibu and Lesetedi (2003) also recorded the same disabilities among Botswana school populations between 5-17 years of age. It was worth noting that a small percentage (2.2%) equally represented all the types of disabilities of learners taking FCS. While several explanations are possible for this small percentage of learners with mobility problems in FCS, one explanation could be that students tend to choose a practical subject where they could easily be accommodated. Out of all the schools studied, only 15% of the schools had learners with disabilities enrolled in FCS and the remaining 85% had none. The school principals who accommodated learners with physical disabilities were asked to share with the researchers how they dealt with issues pertaining to inclusive teaching/learning environment in FCS. Below is a summary of the qualitative responses (representing 65% of the respondents):

- Learners had to choose practical subjects taught on the ground floor only.
- Special working places had to be arranged for the student in the laboratory.
- Teachers had to plan special teaching/learning techniques. (e.g. more theory and less practical work)
- Extra lessons were arranged for learners with disabilities.
- Special tables had to be arranged for wheelchair users.
- Learners with visual and hearing disabilities sat in front of class.
- Offered suitable practical subjects like art.
- Social workers and school counselors were asked to assist the learners.



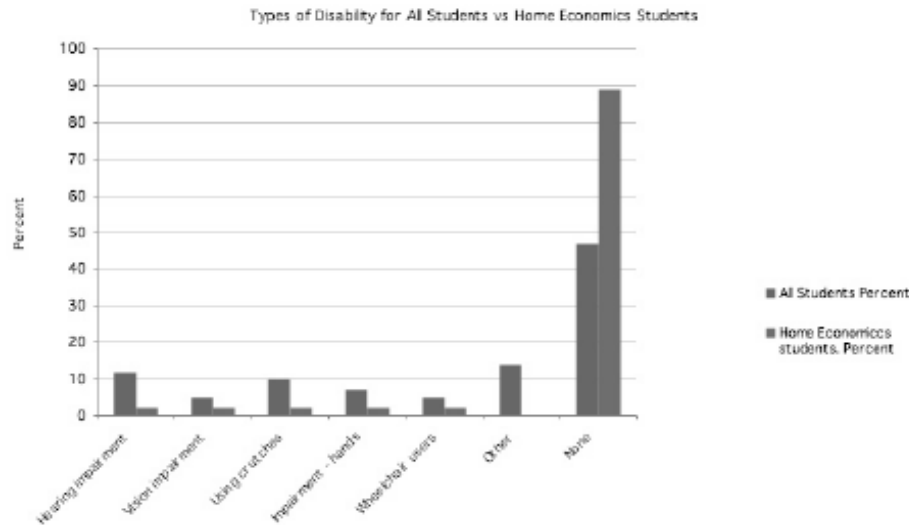


Figure 2. Types of Disabilities for all Students vs. Family and Consumer Sciences Students.

#### *Accessibility of Food Preparation, Cooking and Storeroom Areas*

More than half (56%) of the laboratories' lighting switches, and power outlets (Figure 3) could be accessed by wheelchair users. The level of switches and power points for the rest of the laboratories (44%), however, would require repositioning to accommodate wheelchair users. The cooker controls and ovens in most (88%) laboratories were accessible from a wheelchair level. The other concern found was the level of hobs and grills since cooking lessons included their use. The gas stove type found in some of the laboratories could be too high for wheelchair users. Most counter tops (96%) used for food preparation/work surfaces were too high for wheelchair users. The kitchen sink heights in 94% of the laboratories were also not reachable to wheelchair users. While 74% of the laboratories had sinks installed without leg room and 26% had ample leg room. A common practice that was observed was the situation where leg room spaces were used for storage, thus causing congestion and crowding in laboratories. This scenario was also observed by Mberengwa and Silo (2005) in their study of FCS laboratories. Lever type water taps for sinks, which are user friendly to people with disabilities, were found in only 10% of the laboratories and pull out storages were not installed in any of the laboratories. Wooden shelves in most (88%) storerooms could be reached while 12% were rather too high for someone in a wheelchair. The results also revealed that 66% of the equipment and tools placed on some of these shelves could not be reached. More than half (52%) of the food preparation and cooking areas in the laboratories had no space to maneuver a wheelchair. Results also revealed that 58% of the schools had fire extinguishers in the laboratory and yet only 38% of the fire extinguishers were reachable from a wheelchair level. It was also noted that the number of laboratories without fire extinguishers (42%) was high and none of the schools had any smoke detectors. The majority of the teachers who were asked to comment on safety issues blamed it on the administrators.

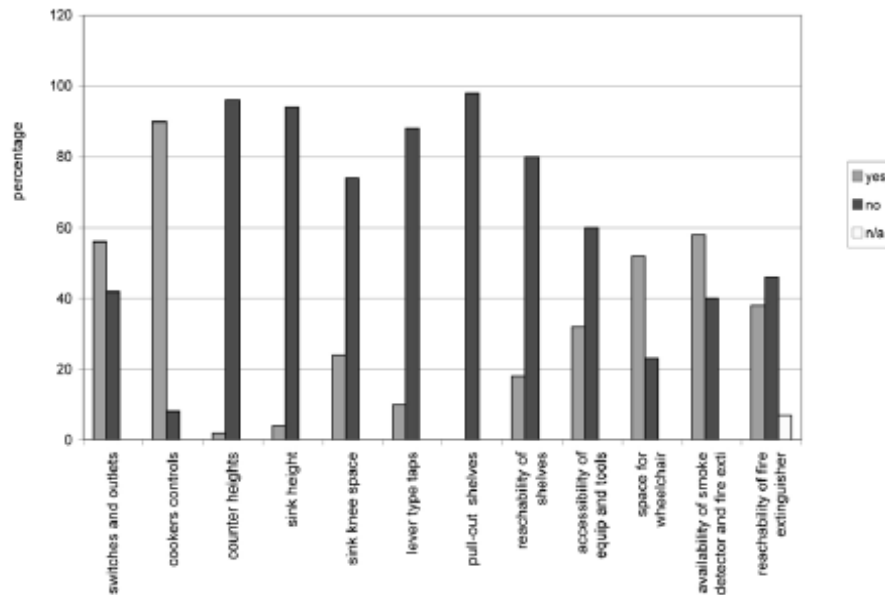


Figure 3. Accessibility of Cooking and Store Room Area.

#### *Accessibility of Corridors*

Some of the junior schools were designed in such ways that as learners changed classrooms they passed through corridors in order to enter the FCS laboratory. Yet in other schools, they accessed the entrance straight from walkways (36%). As indicated in Table 1, only 16% of the schools had the recommended corridor width of 900 mm while 46% had narrower corridors leading to the FCS laboratories. Only 32% of the corridors had recommended flooring for slip resistance and free movement of wheelchairs. Results further reflect that of all the 62% of corridors leading to FCS labs, 56% had good lighting system while 6% had poor lighting.

Table 1

*Accessibility of Corridors*

	Width of Corridors		Slip Resistant Flooring		Demarcation of Floor Levels		Lighting for Visibility	
	N	%	N	%	N	%	N	%
Yes	8	16	16	32	2	4	28	56
No	23	46	15	30	29	58	3	6
N/A	18	36	18	36	18	36	18	36
Missing	1	2	1	2	1	2	1	2
Total	50	100	50	100	50	100	50	100

Note. Yes = accessible; No = not accessible; N/A = not applicable. Missing indicate a burnt down FCS lab which was included in the study

*Accessibility of the Laboratory Entrance*

Table 2 shows the accessibility of FCS laboratories' main entrance. Only 26% of the laboratories and corridor floor levels were accessible therefore did not require a ramp. The laboratories (72%) that required ramps did not have them making the laboratories not easily accessible by learners on crutches and wheelchairs. Since there were no ramps at any of the entrances, handrails were not applicable. The floor finishes of most laboratories were slip resistant therefore allowing easy movement for all the learners. Slippery floor finishes (polished cement floors) were, however, observed in 28% of the laboratories. Door handles of most laboratories (62%) were placed at the appropriate height of 760-915 mm from the floor. The majority of the door opening mechanisms were easily operable although automatic opening doors would be best choice as suggested in the study by Hemmington and Borell (2002). Sixty six percent of the laboratories had entrances large enough to maneuver a wheelchair because there was double door usage, while 32% of the entrance doors were narrow.

Table 2  
*Accessibility of the Entrance*

	Main Entrance Accessibility		Entrance Ramp		Handrails on the Ramp		Height of Door Handles		Door Opening Mechanism		Space to Maneuver		Slip Resistant Floor	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Yes	8	16	0	0	0	0	31	62	42	84	33	66	35	70
No	41	82	36	72	0	0	18	36	6	12	16	32	14	28
N/A	0	0	13	26	49	98	0	0	0	0	0	0	0	0
Missing	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Total	50	100	50	100	50	100	50	100	50	100	50	100	50	100

Note. Yes = accessible; No = not accessible; N/A = not applicable. Missing indicate a burnt down FCS lab which was included in the study.

#### *Accessibility of the Teaching Area*

The table heights (58%) reflected in Table 3 were not within range for use of a person in a wheelchair. Only 40% were accessible. Most laboratories (78%) had enough room to maneuver a wheelchair while some spaces between cookers and work tables for 20% of the laboratories were rather narrow making it difficult to reach stoves. The furniture arrangement (64%) allowed free movement in most cases, but it was observed that furniture could be rearranged in these rooms to allow more room for movement. Some (68%) of the rooms had unobstructed paths without protrusions from the walls, floor, and furniture. The chalkboards (94%) could not be lowered for use by a person in a wheelchair or those of short stature. A discussion with one of the schools' principals revealed that one FCS teacher had to stop teaching the subject because of her height challenges in accessing most of the items in the laboratory.

Table 3

*Accessibility of the Teaching Area by Wheelchair Users*

	Table Heights for Wheelchair Users		Room Space to Maneuver Wheelchair		Free Movement Around Furniture		Obstructions and Protrusions from wall, floor		Accessible Chalkboard	
	N	%	N	%	N	%	N	%	N	%
Yes	20	40	39	78	32	64	34	68	2	4
No	29	58	10	20	17	34	15	30	47	94
N/A	0	0	0	0	0	0	0	0	0	0
Missing	1	2	1	2	1	2	1	2	1	2
Total	50	100	50	100	50	100	50	100	50	100

Note. Yes = accessible; No = not accessible; N/A = not applicable.

### Discussion

FCS in Botswana junior secondary schools is offered as a general education course therefore all learners are enrolled. It is necessary to first determine the accessibility of FCS laboratories for learners with physical disabilities to determine and resolve the challenges they pose for students. The findings of this study indicate that generally various types of disabilities are found in schools among teachers and learners, and most schools have more than one type of disability. The most common disability was physical impairment with the use of crutches followed by hearing impairment. Although nearly all school reported having students with disabilities, only few of them had learners with disabilities enrolled in FCS. The challenges are tied to the practical nature of the subject.

The results indicate that *all* FCS laboratories investigated were not designed to meet the needs of any person with disability. Specifically the laboratories did not provide an appropriate learning environment conducive to learners who are physically challenged. Further, there were no plans to renovate the laboratories to cater for learners with disabilities, either temporary or permanent. The findings of this study are consistent with those of Mberengwa and Silo (2005), which established that FCS laboratories in Botswana's junior secondary schools did not have any special and adaptive place designed for learners with disabilities. In one school, the school principal gave instances where the learners were not allowed to enroll for FCS because of inaccessible equipment and facilities. Effectively, this not only affects the learners' choice of subjects but also limits their career choices. In another school, a teacher had difficulties with teaching FCS because she had physical disabilities and was therefore asked to move to another department which was theoretically oriented. This finding is supported by findings from a study by Hemmingson and Borell (2002) in Swedish mainstream schools. In these schools, some learners with disabilities were restricted or excluded from some of activities, such as handicrafts, sports, or outdoor activities due to challenges encountered in accessing facilities and equipment.

FCS, being a practical subject, requires a lot of circulation space and reaching for items (Chamberlain, 2003). Equipment and other facilities need to be accessible for proper learning to take place. Most of the equipment and facilities were not accessible to learners with mobility problems, especially wheelchair users. Only the switches, outlets, and cooker controls were

accessible. The cooker controls were accessible because they are front-located, while counters and sinks were not accessible because they are too high. The findings revealed sinks that were not designed to allow knee space for wheelchair users; on the other hand, the shelves were not reachable from a wheelchair position.

Despite the daily cooking activities that take place in the FCS laboratories, smoke detectors were not installed in all the laboratories raising safety concerns. Most of the laboratories had fire extinguishers, but through informal discussion a majority of the teachers confessed that they did not know how to operate them. The researchers actually found one FCS laboratory that was burnt down by fire which started during a practical lesson. The location and placement of most fire extinguishers are inaccessible to wheelchair users.

The FCS laboratories are all well placed on the ground floor. However, *all* the laboratories are designed without a ramp at the entrance making them not accessible for wheelchair users. Hemmingson and Borell (2002) reported similar findings where learners indicated accessibility barriers that were caused by architectural features, such as lack of ramps and automatic door-openers in their schools. The chalkboard was also found not to be accessible to a person in a wheelchair because of its high position. This finding agrees with Prellwitz and Tamm (2000) who found that learners with disabilities had difficulties reaching for chalkboard and books because they were placed high. The high positions made it difficult for the learners to perform tasks independently therefore they were excluded from certain activities.

Circulation between cookers and work tables was found not to be adequate especially for wheelchair users. The furniture arrangement also hindered free movement. Hemmingson and Borell found furnishings such as desks, chairs, and other utilities including lack of assistive devices, were also barriers for learners with physical disabilities. Although there is restricted access to equipment and tools required for practical work, most storeroom areas have space to maneuver a wheelchair. Prellwitz and Tamm (2000) also found that most of the wheelchair-bound learners experienced problems with maneuvering their wheelchairs around the cluttered classrooms. There was not enough space to operate the wheelchairs because items such as school bags and chairs made it difficult.

Undoubtedly, laboratories did not have a cooking or sewing area specifically designed for a person with a disability. This means that the subject does not cater for teachers and learners with disabilities. The inclusion of learners and teachers with disabilities should mean adaptation and renovation of FCS laboratories in order to cater to their physical needs.

The main limitation to this study is not interviewing the FCS learners with disabilities to understand the challenges with their learning environment. Pivik, Mccomas, and Laflamme (2002) stress and support the concept of students reporting their opinions about accessibility of school settings. Learners can fully identify and express the accessibility challenges they are facing and possible solutions to them. It is also important to interview the FCS teachers to find out challenges they face when teaching learners with physical disabilities in the current learning environments and to understand how the inaccessible laboratories affect learning performance of the students with disabilities in comparison to those without. Future research should investigate the school physical environment in general as learners move from one classroom to another..

### **Implications**

The study clearly indicates that FCS laboratories in Botswana are not designed with learners with special needs in mind. The findings raise questions on the extent to which goals of inclusive education will be attained. The traditional FCS laboratories currently pose accessibility and safety problems for learners and teachers with disabilities. The findings point strongly to a need for review of current laboratory designs and functionality in Botswana. Specifically, there is need to build awareness among government authorities, school administrators and FCS educators on the importance of adapting laboratories and to accommodate all learners, especially learners with physical disabilities. For successful inclusion to occur, the general education

classrooms should be a place where a range of learners' abilities are accepted and supported. The individual educational needs of every school-age child with a disability within a school must first be evaluated and documented as well as addressed appropriately and adequately. Services, buildings, equipment and facilities for learners with disabilities must be of comparable quality.

Although it is necessary to alter existing facilities or construct new accessible facilities to make the FCS subject available to all learners, accessibility of building structures in schools is far more challenging than simply adhering to standards and codes (Ainsley, 2000). Careful consideration for each need must be made to adequately cater to it and the right design considerations, ideas and concepts must be taken into account. It is anticipated that this study could be a motivation for future studies that will investigate the general accessibility of all spaces in schools, such as other laboratories, classrooms, toilets and offices. Even though the present study focused on the needs of learners with mobility disabilities, it is also important for future research to examine accessibility of the FCS laboratories to learners with other disabilities.

### Conclusion

According to Botswana's Vision 2016, all of Botswana will have access to quality education by 2016. For the vision to be achieved, it should also include people with special needs and their accessibility issues. *The Revised National Policy on Education* (Ministry of Education, 1994) states that learners with special needs should attend normal schools. However, poor service provision for learners with disabilities will hinder their access to education, and compromise their potential to be productive citizens. In most cases, the learners with disabilities are known to need specialized schools and services and sometimes do not receive equal opportunities as students in ordinary schools (SIDA, 2003). The SIDA report indicates that the main obstacle for learners with physical disabilities is physical access to and inside school buildings. However, if the plans do not include the improvement of buildings and facilities, the spirit of inclusive education is hindered. It is important for schools and the Ministry of Education to cater to all types of learners and teachers regardless of their physical status to achieve Botswana Vision 2016 goals. It is recommended that laboratories should be designed with at least one accessible section or unit to cater for FCS learners with physical disabilities. Accessible places or units should not be isolated from other units to avoid segregation that can draw unnecessary attention. Accessibility must extend to buildings and facilities for the whole school to meet the needs of all types of disabilities in terms of circulation, reachability, usability, and safety.

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