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Challenges faced by learners with visual impairment while learning science practical's in an inclusive classroom: Theoretical framework and conceptual framework

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Abstract
This manuscript is an extract of a theoretical framework and conceptual framework from a Master's an on-going study on challenges faced by learners with visual impairment while learning science practical's in an inclusive classroom: a study of two selected schools in Mwense and Kawambwa districts in Luapula province, Zambia. The frameworks suggests that, among the challenges learners with visual impairment can be faced with are learning methods, learning materials, the pupil's ability, the curriculum, the nature of science practical and the teacher aspect. It is argued that if challenges are identified and addressed learners with visual impairment can benefit a lot from education system.

Keywords: Challenges, Science Practical, Learners with Visual Impairment and Inclusive Classroom

Introduction

1.1 Background of the Problem

There have been challenges experienced by learners with visual impairment when learning science practical subjects in inclusive classrooms. This is supported by Agesa (2014) who stated that learners with visual impairment face challenges when learning practical subjects because of being an heterogeneous group with varied nature of difficulties that require adequate attention in curriculum implementation in order to achieve good academic performance when placed in regular or main stream institution to which the researchers are in agreement.

A lot of support concerning the learning of learners with visual impairment at international level has been implemented. For instance, according to Snyder and Dillow (2013) it is estimated that there are approximately 28,000 students in America's public schools with visual impairment who are being provided with instruction in a variety of educational settings such as regular classes. According to these authors, learners with visual impairment receive support in terms of teaching. However, the authors did not identify the challenges faced by learners with visual impairment while learning practical science in regular classes.

There has been also support from African countries towards provision of education to learners with visual impairment. For example, Kumar et al (2001) in their research carried out in selected Ethiopian secondary schools, suggested provision of teaching materials and methods as the best support that make learners with visual impairment learn in an inclusive classroom. The researchers Kumar and others in their research only concentrated on materials and teaching methods provided to the learners with visual impairment in an inclusive classroom but failed to point out the challenges which these learners were facing in an inclusive classroom.

Another example, in Botswana Joseph and others in (2016) carried out a research which investigated classroom support provision to students with visual impairment in an inclusive secondary school. The study found that provision of teaching material is important in the provision of education to learners with visual impairment. In a similar manner the researchers failed to account for the challenges faced by learners with visual impairment in

learning practical subjects in an inclusive classroom.

In Zambia, there has been also support given to learners with visual impairment. Mwaala (2016) conducted a research in Lusaka (Zambia) and his study examined conditions under which learners with visual impairment can learn effectively in inclusive education. His findings were that a clear education policy towards the provision of education to learners with visual impairment is necessary. The researcher identified the policy as one of the support given to learners with visual impairment. However the research conducted by Mwaala did not look into the aspects of the challenges faced by learners with visual impairments while learning practical subjects.

There has been support toward learners with visual impairment learning in inclusive classrooms at international level, for instance in America, African countries such as Botswana and Ethiopia as well as in Zambia. Despite this support the problem of identifying the challenges faced by learners with visual impairment when learning practical science subjects still exists. Therefore the ongoing master's study will aim at identifying the challenges faced by learners with visual impairment when learning practical science subjects in inclusive classrooms.

1.2. Statement of the Problem

There has been support toward learners with visual impairment in inclusive classrooms at international level, for instance in America, in African countries such as Botswana and Ethiopia as well as in Zambia. Despite this support the problem of identifying the challenges faced by learners with visual impairment when learning practical science subjects still exists. Therefore the ongoing study will be identifying the challenges faced by learners with visual impairment while learning practical science subjects in inclusive classrooms.

1.3 Purpose of the Study

The purpose of the ongoing study is to identify the challenges faced by learners with visual impairment while learning science practical in Zambian secondary schools in an inclusive classroom.

1.4. Research Objectives

The ongoing research shall be guided by the following objectives:

1. To find out the challenges the learners with visual impairment face while learning science in secondary schools in inclusive classrooms.
2. To assess how the challenges affect the academic performance of learners with visual impairment.
3. To establish the measures that can be taken to make the learners with visual impairment to learn science effectively in an inclusive classroom

1.5 Research Questions

The ongoing study shall be guided by the following research questions:

1. What challenges are faced by the learners with visual impairment while learning science practical in secondary schools in an inclusive classroom?
2. What are the effects of these challenges on the academic performance of learners with visual impairment?
3. What measures can be put in place to make the learners with visual impairment learn practical science effectively in an inclusive classroom?

1.10. Study Sites

The research shall be conducted in Mwense and Kawambwa districts particularly at Mwense and St Mary's Girls secondary schools in Mwense and Kawambwa respectively. These schools have been selected because they have learners with visual impairments who are included in regular classrooms.

1.6. Significance of the Study

The ongoing study is significant because it might identify the challenges faced by learners with visual impairment while learning science practical in Zambian secondary schools in an inclusive classroom. It is also important because the findings of the ongoing study may be added to the body of knowledge on the challenges faced by learners with visual impairment when learning science practical in secondary schools in inclusive classrooms.

1.7. Limitation of the Study

The ongoing study will be qualitative and will use instruments such as interview schedule, observation checklist and group focused discussions. The research limitation might be that when administering the interview, the respondents may not respond accurately on some of the questions. However, the researcher will cover up this limitation by using other instruments such as observation checklist and focused group discussion such that the questions that will not be answered accurately will be answered in precisely in other instruments mentioned.

1.8 Delimitations

The research will be confined to the two selected secondary schools in Luapula province Mwense and Kawambwa Districts in particular. The delimitation is that the researcher has chosen a population of learners with visual impairment and no other learners with sight from the two selected schools. This is because the answers and the sample for this study will be drawn from this population and not the learners with sight from the said schools.

1.9 Theoretical Framework

This ongoing research will be guided by the Basis-model developed by Oser and Patry (1994). It is an approach which concentrates on learning strategies and opportunities in the classroom as well as well as the aspects of the teacher in terms of teacher expertise and subject theory and practice in the classroom context. The model contains the following aspects namely learning methods, learning materials, the pupil's ability, the curriculum, the nature of science practical and the teacher aspect.

The subsequent paragraphs therefore is trying to explain how learning methods, learning materials, the pupil's ability, the curriculum, the nature of science practical and the teacher aspect can be used in identifying challenges faced by learners with visual impairment in an inclusive classroom.

Learning Methods

According to the model learning methods serves as a concrete frame of reference for learning opportunities and

classroom interaction and it calls for better science education and it has main impact on pupils learning and performance, (Oser and Patry, 1994). In this case it implies that learners with visual impairment will learn science practical better if multisensory learning strategies are used, for example using the sense of hearing, touch and taste. For instance, the learner can use the sense of hearing to get and understand the instructions during science practical. Furthermore, the learner with visual impairment can make use of sense of hearing, for example a learner who is totally blind can listen to a recorded audio. For instance, when testing for the presence of starch, a day before a lesson demonstration the learner who is totally blind can listen to a recorded audio of a lesson demonstration and understands what the practical is all about. Then on the practical day a learner who is totally blind can be paired with a sighted peer who will confirm and inform this learner about the presence or absence of starch after observing colour changes. The learner can also use the sense of touch during practical science to feel the texture of some learning materials such soil samples. Another example on the use of touch in learning practical science is applied when a pupil uses Braille prints to get and understand learning instructions. Furthermore, a pupil can use the sense of taste to test the sour taste in citric fruits like lemons and oranges. Learners with a remaining sense of sight can learn well when large prints are used in writing learning instructions and materials. The learners who are partially sighted can also learn well by sitting closer to the teacher during demonstration of science practical. Learners with visual impairment will benefit from the lesson if they learn in this manner because the challenge they are faced with when learning will be addressed.

Learning materials

The model explains that learning materials plays a vital role in making the learners understand the concepts taught (Oser and Patry, 1994). In this case learner with visual impairment can learn well science practical if the learning materials are raised or embossed. This is because the pupils are able to familiarize themselves after touching the raised learning materials. However, learners with visual impairment cannot understand these materials if they are not adaptive because it is the adaptive features which enable learners with visual impairment to understand the scientific concepts taught during science practical. For example when talking about reproduction in flowering plants, there is need to make two learning materials, one in normal print for sighted learners and the other one in raised print for learners with Visual impairment.

Another aspect under learning materials is that, learning materials such as beakers, measuring cylinders and other pieces of apparatus must be labeled in raised and large print to enable the pupils with visual impairment familiarize themselves with the apparatus and build on scientific concepts to be learnt in a science practical. Pupils must be allowed to touch these kinds of material except sharp objects like surgical blades, sharp glassware apparatus, knives as well as those chemicals like concentrated acids which can be dangerous to them. Learners with visual impairment will benefit from the lesson if they are provided with adaptive materials in this manner because the challenge they are faced with when learning will be addressed.

Pupils' abilities

Learners with visual impairments differ in terms of capabilities such as visual acuities (Oser and Patry, 1994). This implies that, learners with visual impairment differ in terms of their impairment, the extent of their visual acuity and their ability in using whatever vision they have. Even if they have the same identical acuities and fields of vision, this does not mean that they use the vision they have in the same way and capacity. Learning science requires intensive use of the senses, particularly the eyes in order to be a good observer. However, learners with visual impairment have some difficulty in using their eyes due to visual impairment. The educators need to take into account the learner's abilities when carrying out science practical lessons in an inclusive classroom. Learners with visual impairment will benefit from the lesson if their visual acuity is being taken care of because the challenge they are faced with when learning will be addressed.

Curriculum

According to this model the curriculum is understood as a course of study given to a group of learners in a specified period and it has outcome based results, (Oser and Patry, 1994). In terms of learners with visual impairment, the curriculum for science practical should be composed of integrated science (junior level), Biology, chemistry, Physics, science and agricultural science with a practical aspect in each component. The curriculum for learners with visual impairment must have the medium of instruction in Braille and the text books used must prescribed in Braille. The curriculum also demands extra time of 25% given to all learners with impairment, visual impairment inclusive, (Examinations Council of Zambia, 2016). Learners with visual impairment will benefit from the lesson if the curriculum is implemented in this manner because the challenge they are faced with when learning will be addressed.

Nature of science practical

According to the model it is argued that, the nature of science practical requires the leaner to be a good observer of the learning activities and it demands the learner to tell what he or she can see and make conclusions (Oser and Patry, 1994). However, this is different to learners with visual impairment who cannot see by using the sense of sight but requires using other remaining senses to grasp the concepts taught as earlier alluded to. Learners with visual impairment will benefit from the lesson if they use the remaining senses because the challenge they are faced with when learning will be addressed.

The teacher

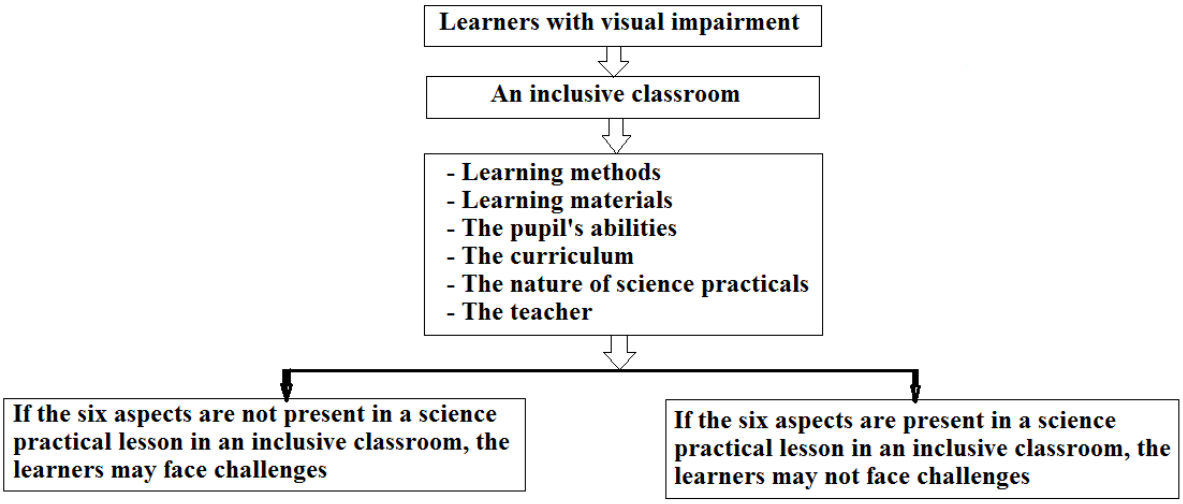
According to the model, it is stated that general professional background or teacher expertise and subjective theory or content has a big impact on the way the learners grasps the concepts taught during science practical lessons in a classroom, (Oser and Patry, 1994). In this case the teacher who is handling learners with visual impairment need to understand an essential aspect of giving quality instructions and how these instructions impacts on learners performance. Thus the teacher needs to have his expertise and subject content to handle such kind of learners in an inclusive setting. Furthermore, the teacher must be acquainted with the content of what he or she will be

teaching the learners with visual impairment. Learners with visual impairment will benefit from the lesson if the aspect of a teacher is taken into account because the challenge faced with by learners with visual impairment when learning will be addressed.

The ongoing study has adopted the Basis model by Oser and Patry, (1994) because it will give guidance on how best learners with visual impairment can learn during science practical lessons because it focuses on the learning methods, learning materials, the pupil's ability, the curriculum, the nature of science practical and the aspect of a teacher which will help in addressing the difficulties learners face while learning science practical in an inclusive classroom. This will address the gap of not knowing the challenges learners face while learning practical science lessons.

1.9. Conceptual Framework

Figure 1.2 A diagramatic representation of conceptual framework of the challenges faced by learners with visual impairment while learning science practicals in an inclusive classroom.



Source : Researcher

This conceptual framework will be effective in the on-going study because it will assist in identifying the challenges faced by learners with visual impairment while learning science practical in an inclusive classroom. In the diagram, the arrows represent a reflective path that the researcher will adopt throughout research process. The framework begins by looking at the learners with visual impairment in an inclusive classroom and the five aspects that will assist the researcher in identifying the challenges which are namely as learning methods, learning materials, the pupil's ability, the curriculum, the nature of science practical and the teacher aspect. Furthermore, the framework will end with the negative and positive effects of the presence and absence of the said aspects when learning science practical in an inclusive classroom.

Learners with visual impairment in an inclusive classroom

According Habulezi (2017) learners with visual impairment are those who cannot use the sense of sight in the learning process. An inclusive classroom is the type of classroom which accommodates learners with different forms of impairment and those without impairment. in an inclusive classroom learners with visual impairment use learning methods which are the styles which they use to acquire knowledge. Pupil's abilities refer to what a particular pupil can do in an inclusive classroom. In an inclusive classroom the curriculum for learners with visual impairment for science practical is composed of integrated science for junior level, then Biology, chemistry, Physics, science and agricultural science for senior level with a practical aspect in each component. The nature of science demands learners to be good observers who must tell the results for instance the colour (s) of some reagents after carrying out a practical. In an inclusive classroom the teacher handling learners with visual impairment need to use his expertise and subject content to handle such kind of learners.

In this study these learners with visual impairment being discussed learn in an inclusive classroom.

The subsequent paragraphs therefore, try to explain how five aspects will assist the researcher in identifying the challenges learners with visual impairment may be faced with such as learning methods, learning materials, the pupil's ability, the curriculum, the nature of science practical and the teacher aspect and the impact for implementing or not implementing them.

The learners with visual impairment in an inclusive classroom access information using their different learning methods while learning science practical.

Learning Methods

A learning method is the style a learner uses to learn or ways in which learners acquire the new knowledge. By knowing a student's learning method, a teacher can encourage pupils to make use of those learning methods or styles in order to maximize their learning. Pupil can recognize their individual learning methods to find what study environment and activities can help them learn best the concepts taught in practical science lesson in an inclusive classroom. Learning methods serves as a concrete foundation for learning opportunities and classroom interaction and it calls for better science education and it has much impact on pupils learning and performance, (Oser and Patry, 1994). The learners with visual impairment will learn science practical better if multisensory learning strategies are used, for example using the sense of hearing, touch and taste in line with the learning methods such as adventurers or independent learning style**,** ponders or

collaborative learners and dependent style of learning.
Teachers have a role or a responsibility to help learners acquire skills, knowledge through classroom interactions by encouraging them to use the learning styles they are comfortable with. Thus the teacher's teaching methods should be modified to suit the learning styles of learners in order to make learning meaningful to them.
There are **three** major distinct ways or styles majority of learners use to receive new knowledge and skills.

Adventurers or independent learning style
Learners discover things on their own and other times they learn through others and ask a lot of questions and use provocative statements as they search for knowledge and skills. They are not shy to respond to learning and quick to respond even when their responses are wrong. In most cases they do not give a thought to what they are learning or doing. They reflect on what they say afterwards. They are comfortable with trial and error to learning. Given chance to talk in class they hardly give chance to others to talk they dominate and teachers struggle to stop them. They teachers as facilitators, listeners and climate setters not as consultants because such pupils believe in themselves that what they say are most correct. They do everything possible to defend their position even if others are not comfortable with it.
A teacher who is aware of adventurers' learners naturally prepares oneself for these learners. These kinds of learners do well with modified teaching methods and not conform to some teaching approaches. Teachers should not discourage these learners but motivate them.

Ponders or collaborative learners
This type of learners approach learning in a reflective or analytical manner. They have a tendency to analyze, reflecting on every piece of information before they take position or respond (Weishaar, 2001). They can work for a long time without being bored. They are usually slow because of their reflective thinking and teachers often mistake them to be slow learner or low performers. Once they are comfortable with the new knowledge they have acquired they have a tendency of searching for reassurance from the teacher or authority sources about correctness of the new knowledge acquired. It is at this time they become collaborators and cooperative when they feel they need to reconfirm their new knowledge.
These learners perceive fellow learners and teachers as co-learners, environmental partners when responding to learning. They are the last ones to put up their hands. They are best performers and are able to give the best. The teacher is required to give sufficient time to these learners in order to encourage them learn more and more.

Dependent style of learning
These types of learners depend on a lot of guidance from other people including their teachers. They rely heavily on other people. These group of learners often drift or deviate from set goals or objectives in their learning. They try as much as possible to avoid learning interaction. They show very little interest in their learning activities. They hesitate, are slow in doing their tasks and in most cases they are not clever in the way they write their classroom exercises. That is to say they do not show competence in what they are doing and they tend to require a lot of help from their teachers. If the teacher does not provide support to then they cannot learn.
Their learning depends on the ability of the teacher to modify the learning approaches and the environment to suit their needs. These learners also depend on the ability of the teacher to stimulate their interest, desire to learn and capacity to sustain interest in their learning. Their successes depend on one to one approach in teaching to maximize their learning. Teachers are forced to use additional techniques including task analysis to make it easy for them to learn.

Task Analysis technique
It is a process of breaking complex skills or knowledge into small teachable skills or portion of knowledge. Each small skill or portion of knowledge forms a small teachable aspect of the main skills. Each unit of this skill is taught separately. A pupil has to move from one step to another until the skill is mastered. For example it can be used in topics such as testing for starch. All complex skills are best taught through task analysis to dependent learners.
The learning methods used by learners with visual impairment helps them to acquire academic information those which is represented in their learning materials.

Learning materials
Learning materials are pieces of materials such as charts, diagrams, text books and others which can help the learner in acquiring academic knowledge. The learning materials plays a vital role in making the learners understand the concepts taught (Oser and Patry, 1994). In this case learner with learners with visual impairment can learn well science practical's if the learning materials are raised or embossed. For example the tactile modifications of preserved specimens and humanely prepared living organisms such as live Cray fish with rubber tubing carefully placed over their pincers could form excellent hands-on specimens in biology (Malone and DeLucchi, 1979). This is because the pupils are able to familiarize themselves after touching the embossed diagrams, enlarged handouts and other raised learning materials. However, learners with visual impairment cannot understand these materials if they are not adaptive because it is the adaptive features which enable learners with visual impairment to understand the scientific concepts taught during science practical lesson. Furthermore, this is confirmed by the research carried out in Botswana, Mavundukure (2001) reveal that learners with in a class taught by a special education specialist Biology teacher are given Brailled notes, embossed diagrams, enlarged handouts, magnifying glasses and laboratory apparatus for tactile observation and these increase accessibility and clearer understanding of the subject matter.
The rate of acquiring academic knowledge depends on the pupils' abilities while using adaptive materials.

Pupils' abilities
Pupil's abilities refer to the skills possessed by learners with visual impairment that of doing an activity correctly. Kumar et al (2001) pointed out that learners with visual impairment have the same range of cognitive ability as other learners who are sighted. Learners with visual impairment also differ in terms of abilities for example intellectual ability such as being below average, on average

and above average while the other ability is the visual acuity, (Oser and Patry, 1994). The extent of their visual acuity and their ability in using whatever vision they have differ. Even if they have the same identical acuities and fields of vision, this does not mean that they use the vision they have in the same way and capacity. Learning science requires intensive ability in the use of the senses, particularly the eyes in order to be a good observer. However, learners with visual impairment have some difficulty in using their eyes due to visual impairment. Thus, the learners need to use the sense of touch in order to be good tactile observers during science lessons. Those with visual residue need to use it during science practical lessons. The educators need to identify and take into account the learner's abilities when carrying out science practical lessons in an inclusive classroom such as tactile activities, residue vision and the intellectual level.

Abilities of learners with visual impairment will determine the type of curriculum modification for practical science lessons in different science subjects.

Curriculum

The curriculum is understood as a course of study given to a group of learners in a specified period according to grade level and it has outcome based results, (Oser and Patry, 1994). In terms of learners with visual impairment, the curriculum for science practical's mainly include integrated science at junior level, then Biology, chemistry, Physics, science and agricultural science at senior level with a practical aspect attached to each component. The curriculum for learners with visual impairment must have the medium of instruction in Braille and the text books used must prescribed in Braille. The curriculum also demands extra time of 25% given to all learners with impairments visual impairment inclusive (Examinations Council of Zambia, 2016).

Erwin et al (2001) report that the development of a science curriculum for children with visual impairment aims at demonstrating the connection between children's play and scientific investigation and the importance of engaging learner with visual impairment in learning science practical at an early age shows that children with visual impairments can do it just like their sighted peers.

The standards of the curriculum and the nature of science practical lessons require that learners with visual impairment are taught using the remaining senses.

Nature of science practical

The nature of science practical requires the leaner to be a good observer of the learning activities and it demands the learner to tell what he or she can see and make conclusions. However, this is different to learners with visual impairment who cannot see by using the sense of sight but requires using other remaining senses to grasp the concepts taught.

The nature of science practical requires to be handled by a teacher who can use expertise and is knowledgeable with the subject matter.

The teacher

A teacher can be defined as a person who impart relevant knowledge in learners or a person who facilitates learners' process of acquiring knowledge, skills and concepts. In as far as acquiring of relevant knowledge, skills and concepts is concerned, the teacher is considered to be an important aspect. According to Oser and Patry, (1994) the general professional background or teacher expertise and subject content has a big impact on the way the learners grasps the concepts taught during science practical lessons in a classroom. The teacher handling learners with visual impairment need to understand an essential aspect of giving quality instructions and how these instructions impacts on learners performance. Thus the teacher needs to have his expertise and subject content to handle such kind of learners in an inclusive classroom. Furthermore, the teacher must be acquainted with the content of what he or she will be teaching to the learners with visual impairment.

Learners with visual impairment learning practical science subjects under inclusive education require the six aspects discussed above in order to benefit from the practical science lessons. On the other hand, if the six aspects are not considered, learners with visual impairments may be expected to face challenges.

The results of using or not using the six aspects during science practical lessons might have the following results

The argument is that, learners with visual impairment may learn better using their learning methods but may not learn better if their learning methods are not identified and learners are not encouraged to use them. In an event where the adaptive learning materials are readily available, the learners with visual impairment may not face challenges during science practical lessons in an inclusive classroom. On the other hand, if the adaptive learning materials are not readily available learners with visual impairment may face challenges while learning science practical in an inclusive classroom. If the learners with visual impairment needs and abilities are taken care of when teaching science practical lessons in an inclusive classroom, learners may not face challenges. However, if the learners with visual impairment needs and abilities are not taken care of when teaching science practical lessons in an inclusive classroom, learners may face challenges. If practical science lessons are given to learners with visual impairment with **extra time** and in accordance with grade level with embossed materials, it can be of benefit to the learners unlike a situation where practical science lessons are taught with no extra time allowance without embossed materials learners would face challenges. The nature of teaching practical science requires the learner with visual impairment to use the remaining senses and if that is not taken into consideration learners are likely to face challenges. If the teacher is not fully trained and not knowledgeable with content matter on teaching practical science, the learners with visual impairment may face challenges, but if the teacher is an expert and knowledgeable while handling science practical, learners may benefit with less challenges.

Conclusion

Based on the discussion, the paper concludes that the Basis-model developed by Oser and Patry (1994) and conceptual-framework of the researchers can be used as one of the model in identifying challenges faced by learners with visual impairment while learning science practical's in an inclusive classroom. It involves aspects namely learning methods, learning materials, the pupil's ability, the curriculum, the nature of science practical and the teacher aspect.

Thus the aspect of learning methods will be a guide in identifying the style a learner uses to learn science practical. The aspect of learning materials will be a guide in identifying the role the material plays in making the learners understand the concepts taught. Furthermore, the aspect of the pupil's ability will be a guide in identifying how learners with visual impairment differ in terms of abilities such as intellectual ability and visual acuities. Then the aspect of the curriculum will be a guide in identifying the curriculum or a course of study given to learners with visual impairment in a specified period according to grade level and its outcome based results and if it is modified. The aspect of the teacher will be a guide in identifying if the teachers will have the general professional background or teacher expertise and subjective theory or content which has a big impact on the way the learners grasps the concepts taught during science practical lessons in an inclusive classroom.

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