Integrating computer technology in the teaching of Biology

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Abstract

Over the past decade, the number of students who gained satisfactory passes at the Caribbean Secondary Education Certificate (CSEC) in Biology in Guyana has been few. This poor performance may be attributed to the traditional method of teaching that was used to teach Biology. This study therefore ascertained if the integration of computer technology into the teaching of Biology would enhance students' academic performance. The study was guided by a null research hypothesis. Hence, the related literature reviewed for this study showed that integrating computer technology into the teaching of Biology can enhance students' academic performance in the subject. A quasi-experimental, pre-test, post-test, non-equivalent control group research design was used for the study. The study used two intact grade 10 classes. One class was assigned the experimental group and the other class was assigned the control group through a simple coin toss. The experimental group was taught Biology using computer technology, while the control group was taught the same topic using the traditional method of teaching. A 20-item multiple-choice Biology achievement test was prepared by the researcher and was used for both the pre-test and post-test. Face and content validation of the instrument was achieved through the contributions from two grade 11 Biology teachers and a measurement and evaluation specialist from the University of Guyana. A reliability coefficient of 0.75 was obtained using Pearson product moment coefficient after a pilot test of the instrument. Data collected were analysed using mean, standard deviation, and t-test. The results of the study showed that there was a significant difference between the academic performance of students in Biology who were exposed to computer technology and those exposed to the traditional method of teaching. It was therefore recommended that computer technology be integrated into the teaching of Biology to enhance students' academic performance.

Key words: computer, technology, academic performance

Introduction and background

Biology is the study of life. It entails what life needs to survive, what makes life possible and how life forms interact with each other. Ministry of Education's Science and Technology strategic plan for Guyana 2008 to 2012, developed by Goolsaran in 2008, states that the study of Biology allows students to become aware of the presence and effects of the forces of nature in their everyday lives, and see themselves empowered to take responsibility for the care and protection of the environment specifically, and the earth in general. Biology therefore plays an important role in how humans interact with the biotic and abiotic components of their environment. This interaction is vital to the survival and sustenance of all living organisms on the planet. Thus, Biology is an imperative area of study, and as such, it is emphasized in the curricula of the Primary and Secondary schools in Guyana. It is part of the integrated or general science curriculum which is taught at the primary and junior secondary school levels. In the senior secondary schools, it is taught as a single subject and offered to those students who intend to pursue disciplines such as Medicine, Nursing, Dentistry and other areas in the natural sciences.

A comprehensive look at students' performance in Biology has revealed that students' performance in the subject area has been quite discouraging. Studies showed that the performance in Biology among students at senior secondary schools in Nigeria were poor (West African Examinations Council (WAEC), 2008, 2009, 2010&2011; Almed, 2008 cited in Yusuf & Afolabi, 2010; Umoke & Nwafor, 2014). Leever (2010) pointed out that students in the United Kingdom were also performing poorly in Biology. In addition, the performance of students in Biology at Bruneian schools was the lowest among the sciences (Yong, 2009). This problem was also evident in the Caribbean Regions. Ogunkola and Fayomba (2009) claimed that the major challenge facing Science Education in the Caribbean was the underachievement in the science subjects among the secondary school students. Sweeny (2003) cited by Ogunkola and Fayomba (2009) noted that of particular concern in the Caribbean was the relatively low extent of Science Education, as suggested by the number of students who successfully pass the secondary level science examination. Sweeny (2003) further stated that a cursory review of Caribbean Secondary Education Certificate (CSEC) results in Biology, Physics, Chemistry and Integrated Science for the past ten years indicated that the pass rate had for most part fallen below 50 % (Table 1).

Table 1. *A summary of Biology (CSEC) results for the Caribbean from 2007-2011*

Year	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6
2007	9.66	24.74	37.92	19.00	8.59	0.08
2008	15.81	27.02	34.43	15.68	6.99	0.06
2009	11.82	25.52	37.38	17.34	7.91	0.03
2010	11.04	26.13	37.97	17.48	7.34	0.04
2011	16.28	24.29	32.51	17.76	9.07	0.10

Source: Caribbean Examination Council (CXC) annual report, 2007- 2011.

Guyana was no exception in terms of poor performance in Biology. An analysis done by the National Centre for Educational Resource and Development (NCERD) from 2000- 2013 showed that students' performance in Biology over the last decade was fair when compared to

Chemistry and Physics; however, the number of students who gained grade1's or 2's at CSEC in the subject area were few (Table 2).

Table 2. *A summary of Biology (CSEC) results in Guyana from 2000-2013*

Year	Grade 1(%)	Grade 2 (%)	Grade 3 (%)
2000	1.10	6.20	27.10
2001	1.70	8.90	30.60
2002	1.80	9.00	33.50
2003	2.70	16.00	34.10
2004	2.40	14.80	35.10
2005	9.30	16.60	32.30
2006	9.00	20.40	34.00
2007	4.80	19.30	38.80
2008	9.86	22.64	38.83
2009	6.69	22.03	39.53
2010	9.20	25.20	35.80
2011	9.00	22.00	38.00
2012	9.10	20.20	34.03
2013	9.34	22.62	32.84

Source: CXC analysis of results for Biology (2000-2010), NCERD

Several researchers have pointed out different reasons for students' poor performance, some of which are due to the abstractness of certain aspects of biology, lack of understanding on the students' part, and certain biological concepts and terminologies (Okeke & Ochuba, 1986; Nzelum, 2010). Ibe (2004) noted that these observed deterioration in students' achievement in biology must have been contributed by the strategies of teaching biology (cited by Chinna & Dada, 2013). Hence, in many instances, it was observed that Biology was taught using the traditional method of teaching, where many concepts were taught and learnt in isolation. Students in these classes were passive and were asked to memorize and regurgitate information; resulting in them being bored and frustrated with their learning.

As such, they were not able to recognise the importance of the subject to real life situations. Usman (2010) emphasized that the present mode of teaching biology in secondary schools whereby teachers' adopt only the lecture method does not in any way provide for sequence of learning experiences. This may have led to the poor performance in the subject area. Hence, the quality of teaching which students were receiving has contributed to their decline interest and performance in science (Leever, 2010). It must also be noted that student achievement in any course of study is a function of instructions. Therefore, approaches to instruction must be considered a serious factor in science education (Umoke & Nwafor, 2014).

As a result of the poor performance in Biology, educators are faced with the challenges of improving students' performance in the subject area. In their search for more innovative instructional pedagogy, the use of computer and other forms of technology are being analysed for their impact on students' academic performance. Research showed that Technology can be used to perpetuate old models of teaching and learning (New Horizon for Learning, 2005) and

motivate students to achieve. Studies have also shown that technology used interactively with discussions and guidance can become a tool for the development of higher order thinking skills (Walker, 1998). Computer technology therefore, might provide students with the opportunities to actively explore Biology as an experimental subject instead of a descriptive one. This active participation in their learning might improve their performance in the subject area. It was against this background, the researcher sought to ascertain if the integration of computer technology into the teaching of Biology would improve student's academic performance.

Purpose

The study aimed at finding out if there was any significant difference between the performance of students in Biology who were exposed to computer technology and those exposed to the traditional method of teaching.

Research hypotheses. The hypothesis for the study was as follows:

Ho1: There is no significant difference between the performance of students who are exposed to computer technology and those exposed to the conventional method of teaching Biology.

Scope and Delimitation. This study was carried out at Berbice Educational Institute using only two Grade ten classes. The control group was taught using the conventional method of teaching. A computer with CD/DVD Rom, LCD projector and computer stimulations were used to teach the experimental group to find out if the integration of computer technology in the teaching of Biology would enhance the academic performance of the students, which was measured by a teacher made achievement test.

Review of related Literature

Theoretical Framework

Schneider (2011) defined educational technology as "the ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources" (p.1). It was further explained as an array of tools that might be proven helpful in advancing students' performance. Hence, the integration of educational technology in the classroom is claimed to be based on three theories of learning, i.e. Behaviourism, Cognitivism, and Constructivism.

Jean Piaget, a cognitivist, believed that learning should be a process rather than some stable state or end process. Jermone Bruner, a critic of some of Piaget's earliest work contended that individuals form or construct much of what they learn and understand (Bruning & Schraw, 1995) as cited by Schunk (1996). However, both theorists have concluded that students are able to gain knowledge through active interactions with their learning. Like Piaget, Bruner advocated student cantered learning. They believed that many of the more traditional methods of teaching involved simply transferring information from the teacher to the child. Therefore, the learner's role is especially passive in such endeavours. In such a classroom, students simply respond, receive, repeat or memorize information given by the teacher. At its best, Piaget claimed that such type of learning is incomplete and very short lived (Piaget, 1974, as cited by Schunk (1995).

The behaviourists advocated that teachers who are faced with the challenges of enhancing students' performances because of the use of the traditional method need to identify the needed changes and proceed in a planned, organized way to adopt a programme that will lead to the desired changes. Thus, integrating computer technology was pointed out as one way to enhancing students' performance, especially in the area of science (No Child Left Behind act, 2001).

Fundamental to the understanding of the theoretical perceptive of the use of educational technology in the classroom, is that students in a Biology classroom who are exposed to computer technology will be active knowledge seekers. They will be given the opportunity to explore and construct their own understanding of biological concepts. Thus, instructions in Biology which integrate computer technology can facilitate extrapolation of content, where students will be able to internalize and make sense of the material presented to them. Computer technology in the classroom encourages students to discover the principles and processes of Biology. The discovery may be guided by the teacher, while sometimes it may be a matter of the individual progress. Piaget (1974) cited in Schunk (1996) postulates that active methodology (computer technology) can foster self-motivation and independent learning, rather than merely transmitting facts and rules. Thus, self-motivation, independent or cooperative discovery can lead to better academic performance in Biology.

Computer technology. The term technology is not a new terminology neither is the use of the computer in the classroom a new idea. But, computer technology is not widely utilized in the classroom. The use of computers in the classroom can help students' complete assigned tasks effectively and efficiently. Hence, Lemon (2005) indicated that computer technology used with the appropriate pedagogical strategies can be used to assist learners in understanding biological concepts and processes. Honey (2001), as cited by Jonassen, Howland, Moore, and Rose (2003), claimed that computers can ensure students' mastery of a particular topic. Riel (2000) added that under the right conditions computer technology can advance students' academic achievement. Thus, computer technology has the potential to foster students' abilities, revolutionize the way they work, think and learn (Berson, 2003). The use of computers in teaching also gives students' greater access to information, promotes critical thinking and problem solving and gives meaning to learning. Therefore, integrating computer technology into the teaching of Biology might enhance students' achievement.

Lemon (2005) stated that computers displaying visualization and activities on a projection screen can be used to illustrate and explain concepts in Biology. According to Krulik (2010) it can mean mimicry, making working replicas or representations for demonstration or analysis of problems that clearly illustrates real life or hypothetical situations. Computer simulation therefore permits the learner to manipulate variables or parameters and then to observe the consequences of their choices. Lemon (2005) further added that web-based stimulations can be used to engage learners in exploring complex phenomenon when materials or activities cannot be duplicated. Hence, computer stimulation is a visual tool that provides the concreteness that is needed for students, especially those in special education (Bennett, 2000). Honey (2001) as cited by Jonassen, Howland, Moore, and Rose (2003), stated that with proper software, questions in the subject can be repeated in many ways until students master the content, adjusting the level where necessary. Hence, the use of computer technology in the teaching of Biology is appropriate, since the subject involves many complex phenomena that

students with special needs may have problems comprehending. Lemon (2005) further stated that students with mild disabilities may lack specific basic skills necessary to perform laboratory activities. The teacher can engage such learners in pre-labs activities to assist them in understanding biological processes. Therefore, by using computer technology as an instructional tool, he advocates that teachers can model effectively the use of appropriate laboratory tool, and organize data so that students could more easily see patterns in order to analyse them. Hence, computer technology has the potential to be beneficial to students of all abilities.

Computer technology can provide a supportive environment that is rich in resources and exploration, creating an atmosphere in which ideas can be expressed freely and provides encouragement when students make an effort to understand (Ragasa, 2008). Morton (1996) explained that when computers are used the following learning processes are engaged:

1. Greater access to information.
2. The teacher is the facilitator of students learning.
3. Students are involved in experimental learning.
4. Face to face communications happens.
5. Expanded creativity is noticed
6. Testing of new knowledge occurs.

Besides, Murphy (1995) postulated that the use of computers will also have the following benefits:

1. Social growth- computer encourages active interaction among students as they constantly exchange and test ideas and share experiences with each other.
2. Problem solving- computers allow for experimental learning; students can test ideas to find solutions for problems.
3. Peer teaching- students work in small groups. This allows them to share knowledge with each other. Thus, the use of computers in the classroom can lead to cooperative learning.
4. Independent work- students who are high achievers can move ahead with tasks and therefore would not feel frustrated that they need to work at the same pace with slow learners. The use of the computer can address the issue of mix abilities in the classroom.
5. Exploration- computers allow students to explore information given and discover principles for themselves.

These skills highlighted by Morton (1996) and Murphy (1995) can promote active physical and cognitive participation of students in constructing their understanding of Biological concepts. These skills are critical for the adolescents' social and cognitive development. However, Nickerson (1995) as cited by Ragasa (2008) claimed that while technology does not promote understanding in and of itself, it is a tool that can help students view learning as a constructive process and as a stimulant to draw students' attention. Therefore, in order to ascertain the effectiveness of integrating computer technology into the teaching of Biology, it was necessary to compare its effects with that of the traditional method of teaching.

Methodology

Research design

The research design that was used for this study was quasi experimental non-equivalent control group design. This was the most appropriate design because the subjects for this study were not randomly chosen. Randomization for an experimental study is neither practical nor feasible in the education system (Ross & Morrison, 1989). Therefore, two intact groups (experimental and control groups) were used for the study. A pre-test was administered simultaneously to the experimental and control groups. A post-test was later administered simultaneously to both groups seven weeks after they were exposed to their respective treatments. The quasi experimental, non-equivalent control group design creates a cause-and-effect relationship, and stipulates that condition X would cause condition Y (Gay, 2000).

Ross and Morrison (1989) claimed that since quasi experimental studies are not true experimental studies, they are prone to internal validity treatment. They identified eight of such threats. They are as follows: history, maturation, testing, instrumentation, statistical regression, selection bias, mortality and diffusion of treatment. If these variables are not controlled, they will affect the results of the study. The study therefore controlled the variables for the history, maturation, mortality, instrumentation, testing, statistical regression, selection bias, and treatment diffusion threats.

Population

The target population for this study consisted of 44 students from the two Grade ten Biology classes at the Berbice Educational Institute, New Amsterdam, Berbice. The students that were used for the study were of the Agricultural science stream and the Natural Science stream. The population comprised of 22 male and 22 female students. The age range of these students was between 14-16 years. Majority of the students were of the African and East Indian descents and resided in region 6 and 5 which include urban and rural areas. The students were of similar chronological and maturation levels and they shared similar social, cultural and socio economic background.

Since there were only two grades ten Biology classes, the two intact classes were used for the study, one as the experimental group and the other as the control group. The experimental and control groups were determined randomly.

Instrumentation

A teacher made achievement test was constructed by the researcher and administered to students of the experimental and control group, before and after the treatments. The teacher-made achievement test was based on two Biology topics in the Caribbean Secondary Education Certificate (CSEC) syllabus: Reproduction in animals and plants. It was an objective test and was made up of 20 multiple choice items. The test was self-instructional and lasted about 35 minutes for an average student. An objective test was used since it facilitates easy marking, unbiased scoring, and accurate coding and analysis of data. Also, an objective test ensures adequate sampling of the subject matter and skills in the cognitive domain.

The teacher made Biology test was validated by two Grade 11 Biology teachers. In addition, a specialist in the field of Measurement and Evaluation from the University of Guyana

also validated the instrument. Their feedbacks and feed forwards were used to improve the instrument.

To test for reliability, the test, re-test approach was used on 25 Grade 11 secondary school students. The test was administered to the students because they were already exposed to the concepts when they were in Grade 10. A reliability coefficient of 0.75 was obtained using Pearson product moment coefficient. Pearson-product moment coefficient is appropriate for analysing interval data.

Procedures

To conduct this study, permission was sought from the head teacher of the Berbice Educational Institute. The purpose of the study and other activities of the study were discussed with the head teacher. After permission was granted, the researcher met with the teachers of the science department to brief them about the purpose of the study. Permission was also sought from the other Biology teacher to use the two grade ten classes for the study. A teacher from the department was asked to help invigilate the pre-test and post-test. The teacher was sensitized on proper test administration procedures.

A pre-test was administered to the two groups (control and experimental) simultaneously. This was done to avoid any interaction between the groups. The instructions of the test were explained to the students and they were also told to ask for further clarification if it was needed. The test scripts were collected by the researcher for scoring and analysis. t-test was used to analyse data to ascertain the equivalence of the two groups (control and experimental group). Since, quasi experimental design lacks randomization, the equivalence of the two groups was determined before the treatment was applied to both groups.

A week after, the researcher taught six lessons to the experimental group using computer technology, and six lessons to the control group using the conventional method of teaching. The post test was administered one week after the treatment. The post-test was administered on the same day, simultaneously to the experimental group and control group. After the administration of the post test, the researcher collected the test scripts for scoring and analysis

Data analysis

Descriptive and inferential statistics were used to analyse the data for this study. The descriptive statistics were mean and standard deviation. These statistics were used to describe the population and the general performance of the population.

The inferential statistics were t-test and Analysis of Variance (ANOVA). These statistics were used to test the two research hypotheses stated for the study. The t-test was used to test hypothesis one because it is appropriate for determining if there is any significant difference between the mean of two groups. Analysis of Variance (ANOVA) was used to test hypothesis two, since it is more appropriate for determining the significant difference among multiple groups. Both hypotheses were tested at alpha 0.05 level of significance.

Results and discussion

Research hypothesis: There is no significant difference between the academic performance of

students in Biology who are exposed to computer technology and those exposed to traditional method of teaching.

Table 3 shows that the pre-test mean of the experimental and control groups were 7.86 and 7.59 respectively. Table 3 also shows the post- test scores of students in both groups. Those who were exposed to computer assisted instructions (experimental group) had a post- test mean of 14, with a mean gain of 6.14. Those who were taught by the traditional teaching methods (control group) had a post-test mean of 9.86. They had a mean gain of 2.27 Thus, both groups showed improvements in their academic performance after treatments. However, the students in experimental group had a greater mean gain.

Table 3. *t- test for significant difference between post test scores of control and experimental groups.*

Groups	N	Mean of Pre-test	Mean of Post-test	Gain	Degree of Freedom	t-value	t-critical	Decision
Experimental	22	7.86	14.00	6.14	21	4.1	2.08	significant difference
Control	22	7.59	9.86	2.27	21	4.1	2.08	significant difference

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In addition, table 3 indicated that the calculated t-value for the post test was 4.1. While the t- critical value tested at 0.05 level of significance was 2.08. Since, the calculated t- value was greater than the critical t- value, null hypothesis one was rejected. Therefore there was a significant difference in the performance of students who were exposed to computer technology and those who were taught via the traditional method of teaching. The students' performance in the experimental group was significantly better than the performance of those in the control group. Thus, it may be safe to state that the better performance was as the result of the experimental treatment, (computer technology), they were exposed to. This finding agreed with the findings of Barney, Bishop, Adlong, and Bedgood (2009). Their revelations are that in a computer simulated classrooms the students are actively involved in the experiential learning. Hence, students in the experimental group were actively engaged during lessons. They were involved in discussions, asked and answered questions, engaged in video clips simulations and power point presentation. Thus, they understood the tenets of the topics discussed during lessons and therefore developed a deeper understanding of the important ideas learnt through individual and group collaboration. Mehlinger (1995) in a study pointed out that with the

integration of technology, learners showed more evidence of cooperative learning. Besides, Lemon (2005) opined that computer technology used with the appropriate pedagogical strategies can be used to assist learners in understanding biological concepts and processes.

It was also observed that students in the experimental group seemed to grasp concepts faster and retain information more readily than those in the control groups. This is in line with Honey (2001), as cited by Jonassen, Howland, Moore, and Rose (2003), who claimed that computers can ensure students' mastery of a particular topic. Besides, (Berson, 2003) noted that the use of computers in teaching gives students greater access to information, promotes critical thinking and problem solving and gives meaning to learning. Hence, under the right conditions, computer technology can advance students' academic achievement (Riel, 2000).

Conclusions

Based on the findings of this study, there was a significant difference between the academic performance of students who were exposed to computer technology and those who were exposed to the traditional method of teaching. This significant difference might have been as a result of the treatment, computer technology that was used to teach the experimental group. It was observed that the integration of computer technology into the teaching of Biology motivated students to be active participants in their learning. This might have led to better performance in the subject area.

Thus, the following recommendations were made:

- Computer technology should be integrated into the teaching of Biology, since it provides optimum opportunity for students to actively participate in the teaching-learning process.
- Public schools should be equipped with the necessary information and communication technology (ICT) facilities to leverage the potentials of computer assisted instructions in schools.
- Both in-service and pre-service teachers should be trained to properly integrate computers in their daily classroom processes.
- Continuous professional development sessions should be organised by NCERD for teachers to gain experience in using the computer. This will enable them to effectively integrated computer technology into their teaching.
- Biology teachers need to work more closely with the school administrators and the information technology teachers to create a schedule for the use of the school's computer laboratory.
- Further empirical studies should be carried out on the use of computer for instructional purposes at different levels to provide sound basis for the integration of computer in Guyanese school.
- Appropriate software, new technologies and modern Audio-Visual aids like multimedia should be developed, modelled and distributed by NCERD to be used by teachers to make the learning process effective as well as interesting.

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Appendices

Appendix 1. BIOLOGY TEST (Sample Items)

1. Which plant stores food in its roots?
   A. Canna lily B. Onion C. Irish potato D. Sweet potato

2. Which of these is an example of **only** artificial vegetative reproduction?
   A. bulbs B. cuttings C. rhizomes D. runners

3. Which of these is **not** an advantage of asexual reproduction?
   A. new plant varieties are produced.
   B. Many offspring can be produced.
   C. Parent food resources used for the young.
   D. offspring produced without a dormant period.

4. Asexual reproduction in Amoeba is:
   A. budding B. spore formation
   C. multiple fission D. binary fission

5. These are examples of asexual reproduction **Except** for:
   A. spore formation B. budding
   C. fertilization D. binary fission

Answers: 1. D; 2. B; 3. A; 4. D; 5. C

(For the complete questionnaire, please contact with the author)

Appendix 2. Sample Lesson plans for experimental and control groups

General Objectives:

Students should demonstrate:

1. An understanding of the perpetuation of life by asexual and sexual means.
2. Understanding of the process by which life is perpetuated.

Lesson plan for control group

Class: Grade 10 **Time**: 9: 50- 11:00 hrs **Duration**: 70 minutes
Subject: Biology **Topic**: Reproduction

Specific objectives:

1. After discussion, students will correctly define the term reproduction in at least one sentence within 3 minutes.
2. After discussion students will correctly state the main purpose of reproduction.
3. After discussion, students will correctly differentiate between sexual and asexual reproduction.
4. After discussing reading materials, students will correctly list at least two advantages and two disadvantages of sexual and asexual reproduction.
5. After observing pictures, students will correctly describe 4 methods of asexual reproduction.

Content:

Topic: Reproduction

Definition of reproduction: reproduction is where living things make more of the same kind.

The main purpose of reproduction is to sustain life on earth

.

Comparison between sexual and asexual reproduction

Asexual reproduction	Sexual reproduction
One parent	Usually two parents are needed.
Identical to parent	Different from parents
Simple organisms and plants	Almost all organisms
Cell division is mitosis	Cell division is meiosis

Advantages and disadvantages of asexual reproduction

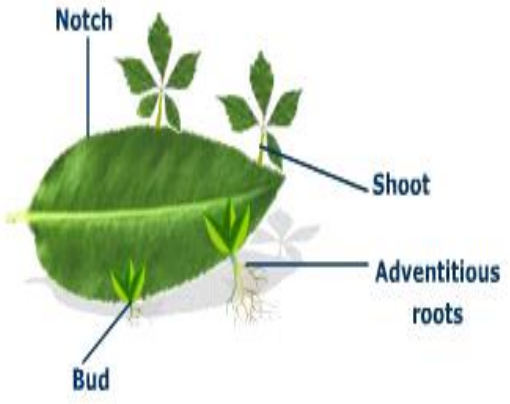
Advantages	Disadvantages
Exact repetition of particular characteristics, therefore possible to conserve desired traits.	Improvement of quality is not possible, as all offspring are identical to parents.
Production of offspring is not risky	Organisms are unable to adapt to changes.
Food resources of parents available for the growth of new organisms.	Any disease in the parent organism will automatically pass on to the offspring.
Rapid growth is possible as no resting period is needed.	Overcrowding may result as offspring are close to the parent.

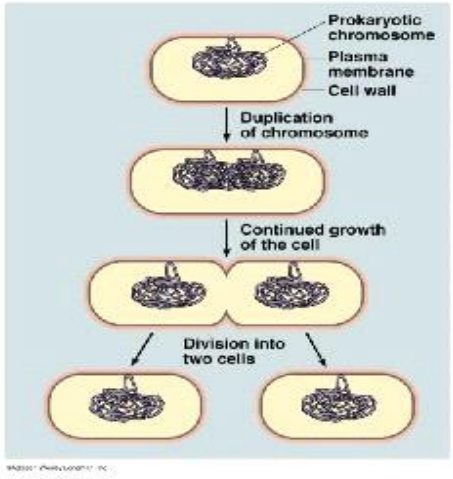
Advantages and disadvantages of sexual reproduction

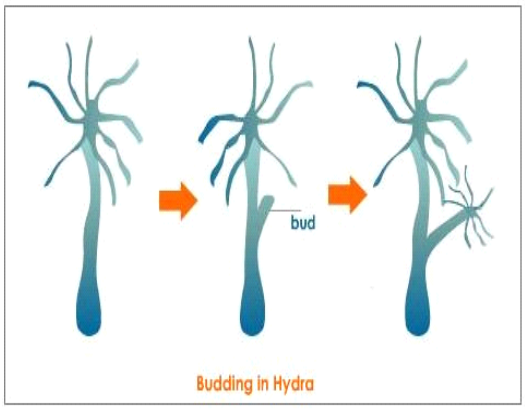
Advantages	Disadvantages
Offspring have variety- different from each other and from the parent.	Not possible to conserve desired traits, as offspring vary.
Seeds may be resistant to poor conditions such as drought and can remain dormant	Several stages involved: mating/ pollination, fertilization.
Seed dispersal allows offspring to spread away from parents.	Seeds and eggs have limited food supplies for growth.
Allows for breeding of new plant and animal with different characteristics	Animals and plants have to develop special means for bringing gametes together.

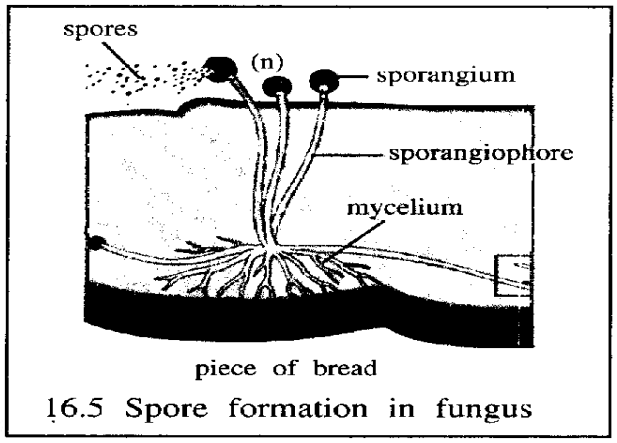
Method of asexual reproduction

1. Binary fission
2. Budding
3. Spore formation
4. Vegetative reproduction









Previous knowledge: Students are familiar with the terms sexual and asexual reproduction.

Resources: Macmillian CXC Revision Guides: Biology by June Mitchelmore, note books, pens, chalkboard, chalk,

Methodology:

Teacher's activities	Students' activities	minutes
Introduction • Introduces lesson by recapping previous lesson on growth and development so as to link it to new topic • States lesson topic and discusses same with students.	• Students listen to teacher. • Participate in revision by answering questions in complete sentences.	5 mins
Development: **Stage 1** • Writes topic on the chalk board and gives a brief description of what is reproduction. • Asks selected students to read their definition. • Discusses students responses	• Writes topic in their notebooks. • Students listen to teacher and then write the definition for reproduction in their notebooks. • Listen to peers. • Made modification to definition if necessary.	5 mins

Stage 2 • Explains the purpose of reproduction to class. • Calls on selected students to read what they have wrote in their notebooks. • Discusses what students wrote in their notebooks.	• Listen to teacher and then write the main purpose of reproduction in their notebooks. • Read what they wrote in their notebooks. • Make corrections to what they wrote in their note books if necessary.	10 mins
Stage 3 • Tells students that there are two types of reproduction. • Discusses the types of reproduction with students. • Makes short notes on the types of reproduction on the chalk board.	• Listen to teacher and then participate in whole class discussion. • Copy notes from the chalk board.	10 mins
Stage 4 • Distributes reading materials from text to students. • Discusses reading material. • Writes a summary on the advantages and disadvantages of sexual and asexual reproduction the chalkboard and instructs students to copy same.	• Read material on sexual and asexual reproduction and then participate in class discussion by identifying the advantages and disadvantages of each. • Copy summary in their note books.	15 mins
Stage 5 • Tells students that they are different methods of asexual reproductions and then asks students to observe pictures on pg 119-120 of their text book. • Asks to identify the different method of asexual reproduction and teacher discusses each method. • Gives instructions.	• Listen to teacher attentively. • Observe pictures and identify the different methods of asexual reproduction. • Describe each picture. • Copy notes from text and make sketch of illustrations in their note books.	15 mins
Conclusion • Concludes the lesson by asking students questions on what was done in today‘s lesson. E.g. 1. What is reproduction? 2. What is the purpose of reproduction? 3. What are two differences between asexual and sexual reproduction? 4. What are three advantages and disadvantages of asexual and sexual reproduction? 5. Describe a method of asexual reproduction:	• Selected students will answer questions in complete sentences.	10 mins

Lesson Plan for Experimental group

Class: Grade 10 **Time:** 9:50-11:00hrs **Duration:** 70 minutes
Subject: Biology **Topic:** Reproduction

Specific objectives:

1. After viewing a power point presentation on reproduction, students will correctly define the term reproduction in one sentence in 2 minutes.
2. After viewing power point presentation, students will correctly state the main purpose of reproduction.
3. After a power point presentation on the types of reproduction, students will accurately differentiate between sexual and asexual reproduction.
4. After discussion, students will correctly list at least two advantages and disadvantages of sexual and sexual reproduction.
5. After viewing a five minute video extract, students will accurately describe four methods of asexual reproduction.

Content:

Topic: Reproduction

Definition of reproduction: reproduction is where living things make more of the same kind.
The main purpose of reproduction is to sustain life on earth.

Comparison between sexual and asexual reproduction

Asexual reproduction	Sexual reproduction
One parent	Usually two parents are needed.
Identical to parent	Different from parents
Simple organisms and plants	Almost all organisms
Cell division is mitosis	Cell division is meiosis

Advantages and disadvantages of asexual reproduction

advantages	disadvantages
Exact repetition of particular characteristics, therefore possible to conserve desired traits.	Improvement of quality is not possible, as all offspring are identical to parents.
Production of offspring are not risky	Organisms are unable to adapt to changes.
Food resources of parents available for the growth of new organisms.	Any disease in the parent organism will automatically pass on to the offspring.
Rapid growth is possible as no resting period is needed.	Overcrowding may result as offspring are close to the parent.

Advantages and disadvantages of sexual reproduction

advantages	disadvantages
Offspring have variety- different from each other and from the parent.	Not possible to conserve desired traits , as offspring vary.
Seeds may be resistant to poor conditions such as drought and can remain dormant	Several stages involved: mating/ pollination, fertilization.
Seed dispersal allows offspring to spread away from parents.	Seeds and eggs have limited food supplies for growth.
Allows for breeding of new plant and animal with different characteristics	Animals and plants have to develop special means for bringing gametes together.

Method of asexual reproduction

1. Binary fission
2. Budding

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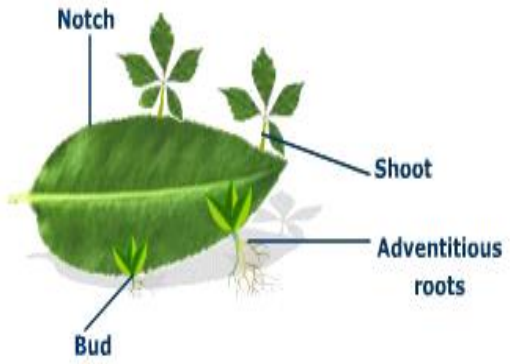

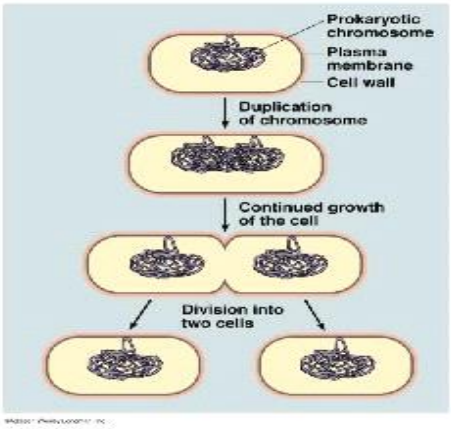

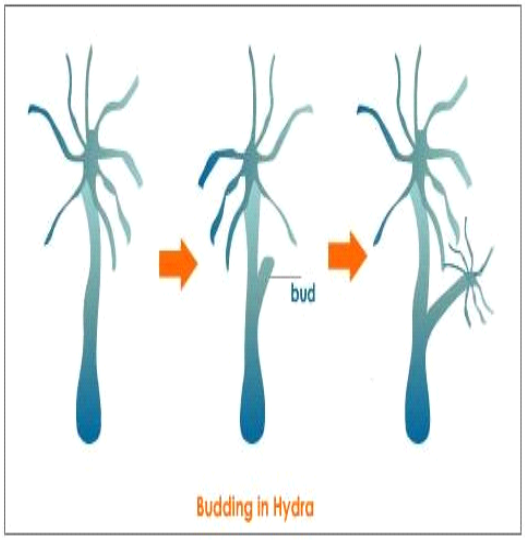

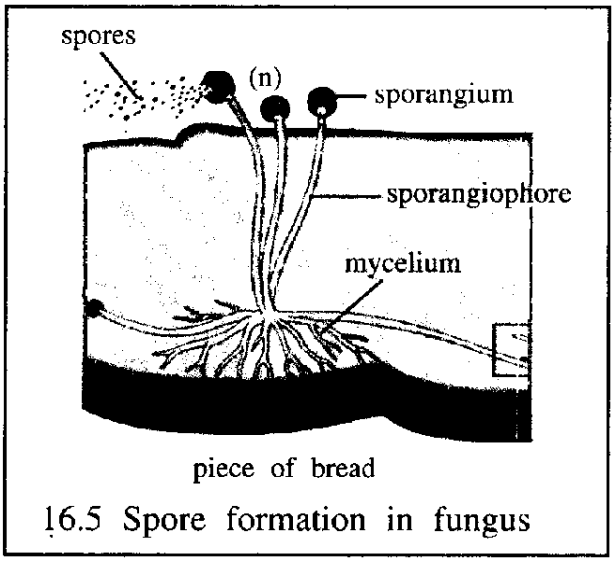

16.5 Spore formation in fungus

Previous knowledge: Students are familiar with the terms sexual and asexual reproduction.

Resources: Macmillian CXC Revision Guides: Biology by June Mitchelmore Pg 119-120, computer(s), LCD projector, stimulation (video) white screen, notebooks, pens, pencils, students

Methodology:

Teacher's activities	Students' activities	Duration
Introduction: • Introduces lesson by showing students a picture using the computer and LCD projector screen. • Asks students to suggest the topic for the lesson. • Praises students' efforts. • States lessons objectives and tries to link previous lesson to today's topic.	• observe what is displayed on screen • Suggest what the lesson would be about. • listen to peers • Read topic displayed.	15 mins
• Displays topic on the LCD projector screen.	• Form groups of six. •	

Development : **stage 1** • Groups students into small groups. • Instructs students to formulate a definition for reproduction and then the purpose of reproduction after viewing a power point presentation. • Invites members of the group to read their definition and state the main purpose of reproduction to the class. • Discusses students' responses. • Instructs students to modify definition or statement of if necessary.	• Each group will formulate a definition and state the main purpose of reproduction. • After which they will discuss same with class. • Modify definition if necessary	
Stage 2 • Conducts another power point presentation on the types of reproduction • Praises students' effort. • Discusses students' responses.	• Work in group and differentiate between sexual and asexual reproduction. • Each group discusses their finding with class.	10 mins
Stage 3 • Asks students to state the advantages and two disadvantages of sexual and asexual reproduction. • Asks and answers students' questions. • Praises students. • Discusses student's findings to tasks and their responses to questions. • Displays further information and discusses same with students.	• Individually, write two disadvantages and two disadvantages of sexual reproduction and asexual reproduction. • Discusses the advantages and dis-advantages of sexual and asexual reproduction. • Presents findings to the class. • Ask and answer teacher's questions in complete sentences • Participate in discussion.	15 mins
Stage 4 • Plays a video clip on the computer title" methods of asexual reproduction" • Invites students to present findings. • Praises students/ group efforts. • Discusses students' responses.	• Students view video • Identify the method of asexual method of reproduction • Discuss in their groups how the living organisms are able to reproduce asexually.	10 mins
Conclusion: Recaps lessons by asking students' questions to highlight main points. **Home work** Asks students to make large label diagrams of the male and female reproductive organs in their notebooks.	• Answer question in complete sentences. • Copy home work. • Ask question for clarification if necessary.	15 mins