TEACHING AND ASSESSMENT STRATEGIES ADOPTED BY LECTRERS FORSUSTAINABLE DEVELOPMENT OF SCIENCE AND TECHNOLOGY-ORIENTED TERTIARY INSTITUTIONS IN IMO STATE

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Abstract
This studyexamined teaching and assessment strategies adopted by lecturers for sustainable development of science and technology-oriented tertiary institutions in Imo State. The design of the study was descriptive survey. Three research questions were drawn from the purpose of the study. The population of the study was made up of 502 final year students of the departments of Science Laboratory Technology, Agriculture and bio-environmental technology and chemistry of Federal University of Technology Owerri (FUTO) and Federal Polytechnic Nekede Owerri (FPNO). The sample size was 248. Random sampling technique was used to select the respondents from the departments. The researchers made use ofa 24- item 4-point modified Likert type questionnaire. Reliability index was determined at a value of 0.81 using Cronbach Alpha. The data collected was analysed using mean and standard deviation. The result showed that lecturers adopted teaching, assessment and feedback strategiescontribute in the sustainable development of science and technology-oriented tertiary institutions in Imo State. The researchers recommend among others that since the

knowledge of science and technology is very important in the entrepreneurial skill development of students, lecturers are advised to put more efforts in improvingstudents ability to stand practically on their own.

Introduction

Teaching strategies also known as instructional strategies are methods that teachers use todeliver their course materials in ways that keep students engaged and practicing different skills sets. An instructor may select different teaching strategies according to unit topic, grade level, class size and classroom resources.

Many kinds of teaching strategies are employed to achieve teaching and learning goals andsupport different kinds of students. Teachers select strategies according to the needs of thestudents and the requirement of the course. Instructors can also select classroom activities according to the instructional methods/techniques. Specific techniques can also be employed to teach particular skills like strategies for problem solving. Activities that promote thinking and discussion in small groups like think-pair share activities that get students outside work well for active learning frameworks.Active learning is a learner-centredapproach to teaching which is based on understanding of how students learn by actively connecting new information in order to create personal meaning (Barkley, 2010).

Active learning instructional strategies are the various types of activities taking place in the class (face-to-face, online, or outside of class) that engage learners in in-depth thought about the subject matter in a course. This strategy is against the traditional method where students passively "receive" course content solely from live or recorded lectures. Active learning requires the students to become active participants in their learning process.

One of the characteristics of active learning strategies is the development of4Cs: Critical thinking, Creativity thinking, Collaboration and communicative skills (UBEC/ SUBEB 2021). Active learning builds on constructivist learning theory which posits that people learn by connecting new ideas and experiences to what they already know. Dara (2008) observed that teaching science courses by linking concepts to real

life-situations motivates students to learn and that when learning materials are taught with concrete instructional materials and concepts made real, students develop interest and learning is permanent.

The Federal; Republic of Nigeria (FRN, 2013) observed that educational activities shall be centred on the learner for self-development and self-fulfillment and modern educational techniques shall be used and improved upon at all levels of the educational system.

The following are among the student-focused teaching strategies used in the classroom: Convergent and divergent thinking; Project-based learning; Peerteaching;Inquiry-based learning &Problem-based learning, etc.

Convergent thinking focuses on finding one well-defined solution to a problem while divergent thinking is a thought process used to generate creative ideas by exploring many possible solutions. Both are two complementary method to explore ideas,work towards goals, and address challenges. Both approaches are necessary and lead to unique solutions to challenges that require exploration and creativity. Convergent and divergent thinking teaching strategy allows teachers to adjust lessons to the range of skill level present in a class while also supporting progress. Teachers observe students and use formative assessment methods in order to make sure class experiences can be adjusted to individual skill and ability levels as appropriate.

Project-based learning allow students to engage in learning about a topic over a period of time, and may help the development of deep understanding. Project-based learning can also incorporate a variety of skills and strengths and students work independently or together to make their productions like carbonated beverages, Cassava starch production, Cassava/yam flour processing, Fadama farming, Farm tool production, Fish farming, Fruit processing, Garri production, Goat/sheep rearing, Grass cutter rearing, Livestock feed production, Poultry, Piggery,Rabbit farming, Turkey farm etc. for students in agriculture and Bio-Environmental Technology

Aloe vera soap production, Antiseptic soap production, Car washing soap production, Detergent production, Boundary soap and bleach production, Toilet bowl cleaner etc.Adhensive production, Battery electrolyte production, Car liquid wax, Carburetor cleaner, Fertilizer production, Fumigation services, Herbicides production, Home

disinfectants, Paint production, Stain removers production, Termite proofing etc. for students in science Laboratorytechnology and chemistry.

Some of the above productions cannot be successfully done without enough practice. Candida (2013) said that those productions are associated with the concept of practice which relates to the acquisition of skills, knowledge and mindset through deliberate hands-on action-based activities that enhance entrepreneurial performance. He said that learning entrepreneurship requires practice and sometimes it is difficult to measure the impact of practice until you actually play the game.

Inquiry-based learning emphasizes the importance of effective questioning and thinking skills in learning process. Students consider key questions that need to be answered to understand a given topic, then follow through to collect information, make hypothesis, participate in activities, and pursue answers in an open environment.

Active learning instructional strategies incorporate elements of Project-based and Inquiry-based learning in order to allow students to pursue their own learning paths.

Other teaching strategies likeBlended learning allows students to do part of their learning inan independent and digital environment, and part of it in a face-to-face classroom setting. This technique combines the strengths of both settings to create a well-rounded experience that gives students opportunities to pursue their learning in their own time, and to have in-person interactions to consolidate what they have learned.

- Flipped classroom invert the traditional teaching model. Here, students are assigned pre-learning before class so that classroom time can be given over to problem solving, one-to-one feedback and students collaboration. Flipping classroom may allow students to make a more effective progress during class-time, having prepared for the lesson beforehand and receiving more focused support and feedback from teachers and peers alike.

- Cooperative learning encourages structuring classes into groups to foster communication and working together in small units. Instructors can strategically form groups around students with varying skill levels and learning styles to promote collaboration, communication and social skills. Information about student learning through the above teaching strategies can be assessed through examinations, tests, assignments, Internship, and other field experiences.

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Assessment of the students help them to understand their errors, understand the feedback received on their errors, and help them improve. Assessment work as an excellent feedback mechanism to let the students know about their progress. Assessment may also provide another opportunity to assimilate the new information and re-do the exam to improve performance.

Assessment method should help the instructor answer the questions "How do I know the required learning that has taken place? What might I need to modify about the course to best support studentslearning?" Methods of measuring students' learning are often characterized as summative or formative assessment. Summative assessment include test, quizzes and other graded course activities that are used to measure students' performances. They are cumulative and often reveal what students have learnt at the end of course unit or the end of a course. Within a course, summative assessment includes the system for calculating individual student's grade. Here the teachers asks students if they understand or have questions. Formative assessment is any means which students receive input and guiding feedback on their relative performances to help them improve. It can be provided face-to-face either in written comments on assignment or oral assignment. This assessment reveal how and what students are learning during the course and often inform next steps in teaching and learning. Here the teacher asks the students at the end of the class period to write the most important points or the most confusing aspects of the lecture on index card. Collecting and reviewing the responses provides insight into what your next teaching steps might be. Providing feedback on these themes to students gives them insight into their own learning.

Science and technology education is an important instrument in the search for sustainable development and poverty reduction. This is why UNESCO encourages the design of effective science and technology education programmes by promoting gender sensitive socio-cultural and curricular activities that promote a multi-disciplinary approach to science and technologyeducation by giving particular attention to the provision of basic knowledge, life skills and scientific literacy for all as well as preparation for the world of work.

Science is described as expertness skills or proficiency resulting from knowledge while technology is the application of science to the

arts.(Standard International Media Holding. 2013). Science and technology lessons allow students to be creative while also developing new skills and grasping an understanding of how things work, which they can then use in the future, to pursue related career or simply as a subject of interest. It is increasingly a significant part of the society as children see it as natural that they should learn about appliances and systems they rely on a daily basis (Centre for Education (n.d)).

Since the knowledge of science and technology is very important in the entrepreneurial skill development of students in particular and sustainable development of any nation, it is then worthwhile to investigate the teaching and assessment strategies adopted by lecturersfor sustainable development of science and technology-oriented tertiary institutions in Imo State.

The study generally is aimed at investigating the teaching and assessment strategies adopted by lecturers for sustainable development of science and technology-oriented tertiary institutions in Imo State.

To achieve this purpose, three research questions were posed to guide the study.

1. What teaching strategiesare adopted by lecturers for sustainable development in science and technology-oriented tertiary institutions in Imo State?
2. What assessment strategiesare adopted by lecturers for sustainable development in science and technology=oriented tertiary institutions in Imo State?
3. What feedback methods are adopted by lecturers for sustainable development of science and technology-oriented tertiary institutions in Imo State?

Method

This study adopted descriptive survey design. A random sampling technique was used to select two technology-oriented tertiary institutions in Imo state which offer science and technology as part of entrepreneurship education. The two science and technology-oriented tertiary institutions in Imo State used for the study are Federal University of Technology Owerri (FUTO) and Federal Polytechnic Nekede Owerri (FPNO). The population of the study is constituted by 502regular students who are in their final year degree/HND courses.The department's

includeScience Laboratory Technology, Agriculture and Bio-Environmental Technology and Chemistry. This population is made up of a total of 268 students for FUTO and 234 for FPNO. These are made up of: for FUTO 104, 116 and 48 respectively for Science Laboratory Technology, Agriculture and chemistry while for FPNO, there are 74, 107 and 53 respectively in the same progression. A random sampling technique was used to select the students in those departments.

The sample size was 251. While after data collection, 248 responses were received.The researchers designed a 24-item 4 point modified Likert-type questionnaire titled: Teaching and assessment Strategies Adopted by lecturers In Science & Technology Questionnaire (TASABLISTQ).The respondents indicated their level of agreement to the items by ticking one of the response options of Strongly Agree (SA) =4 point, Agree (A) = 3 points, Disagree (D) = 2 points and Strongly Disagree (SD)=1 point for the positively skewed items. Two experts in the field of Measurement and Evaluation validated the instrument. Cronbach Alpha was used to establish the reliability and a value of 0.81 was obtained. The data collected was analyzed usingmean and standard deviation

Items having mean scores of 2.5 and above indicate agreement whileItems having mean scores below 2.5 indicate disagreement.

Result of the finding:

Research Question 1: What Teaching Strategiesare adopted by lecturers for sustainable development in science and technology-oriented tertiary institutions in Imo State?

Table 1: Showingmean responses on theteaching strategies adopted by lecturersfor sustainable development in science and technology-oriented tertiary institutions in Imo State?

S/N	Question Items	No of score	SA	A	D	SD	Total	Mean/Score X
1	Departmental course outline are given to us before teaching	N	108	101	39	-	248	
		Nx	432	303	78	-	813	3.28
2	Lecturers teach their courses by linking their concepts to real life	N	68	105	68	7	248	
		Nx	272	315	136	7	730	2.94

	situation.							
3	We are engaged in practical teaching outside the school.	N	-	28	99	121	248	
		Nx	-	84	198	121	403	1.63
4	Simple areas of course content are taughtby lecturers and difficult aspects are given as assignment.	N	87	94	27	40	248	
		Nx	348	282	54	40	724	2.92
5	The entire course content are covered before assessing us.	N	21	62	124	41	248	
		Nx	84	186	248	41	559	2.25
6	We areguidedin acquiring relevant entrepreneurial skills such as: soap making, perfumes, rearing of animals, baking of cakes, bread etc	N	67	78	50	53	248	
		Nx	268	234	100	53	655	2.64
								15.66

The result shows a grand mean value of 2.61, and standard deviation of 0.54. The result of the finding reveals mean values of 3.28, 2.94, 2.92 and 2.64 for questionnaire items 1, 2,, 4 and 6 respectively This shows that lecturersgive the students departmental course outline before teaching, teach their courses by linking their concepts to real life situation, teach Simple areas of course content while difficult aspects are given as assignment, and guide students in acquiring relevant entrepreneurial skills such as: soap making, perfumes, rearing of animals, baking of cakes, bread etc.

: . Questionnaire items 3 and 5 have mean values of 1.63 and 2.25 showing that lecturers do not engage students in practical teaching outside the school and do not cover the entire course contentbefore assessing the students.

Research Question 2: What assessment strategies are adopted by lecturers for sustainable development ofscience and technology=oriented tertiary institutions in Imo State?

Table 2:   Showing mean responses on the assessment strategies adopted by lecturers for sustainable development in science and technology=oriented tertiary institutions in Imo State?

S/N	Question Items	No of score	SA	A	D	SD	Total	Mean/ Score X
7	Lecturers give assignments so as to cover enough course outline.	N	68	90	90	-	248	
		Nx	272	270	180	-	722	2.91
8	Lecturers give objective test to give enough information about the course.	N	27	94	97	40	248	
		Nx	108	282	174	40	604	2.44
9	Lecturers use quiz to achieve content coverage.	N	86	52	50	60	248	
		Nx	344	156	100	60	660	2.66
10	Students are assessed through activity-oriented practice as recommended by the curriculum.	N	50	120	64	14	248	
		Nx	200	360	128	14	702	2.83
11	Lecturers focus their assessment on theory based testing.	N	28	21	83	116	248	
		Nx	112	63	166	116	457	1.84
12	Student do enough practical work for assessment	N	85	130	21	14	248	
		Nx	332	390	42	14	778	3.12
13	Students are given enough take home assignment during the course of training.	N	48	124	55	21	248	
		Nx	192	372	110	21	695	2.90
14	Students grading is based on the following:							
A	Quiz	N	91	33	74	50	248	
		Nx	364	99	148	50	661	2.67
B		N	110	55	62	21	248	
	Take home assignment	Nx	440	165	124	21	750	3.02

			SA	A	D	SD	Total	Mean
C	Practical test	N	45	97	53	53	248	
		Nx	180	291	106	53	630	2.54
D	Oral test	N	16	41	50	141	248	
		Nx	64	123	100	141	428	1.73
E	End of semester	N	97	44	70	37	248	
	Examination	Nx	388	132	140	37	697	2.81
								31.47

The result of the finding also reveals mean values of 2.91, 2.66, 2.83, 3.12, 2.90, 2.67, 3.02, and 2.81 for questionnaire items 7, 9, 10, 12, 13, 14a, 14b 14c and 14e respectively. This revealed that Lecturers give assignments so as to cover enough course outline, use quiz to achieve content coverage.assess students through activity-oriented practice as recommended by the curriculum, give enough practical work for assessment, give enough take home assignment during the course of training. The study also showed that lecturers grade students performances with quiz, Take home assignment, Practical test, and End of semester examination

Items 8, 11 and 14d have mean values of 2.44, 1.8 and 1.73 respectively This signified that lecturers do not give objective test to give enough information about the course., do not focus their assessment on theory based testing and grading not based on oral test

Research Question 3: What feedback strategies are adopted by lecturers for sustainable development of science and technology-oriented tertiary institutions in Imo State?

Table 3: Showing.Mean responses on feedback strategiesadopted by lecturers for sustainable development of science and technology-oriented tertiary institutions in Imo State?

S/N	Question Items	No of score	SA	A	D	SD	Total	Mean/ Score X
15	Corrections are given to usafter group presentations.	N	91	58	58	41	248	
		Nx	364	174	116	41	695	2.80
16	The corrections I	N	14	130	90	14	248	

	receive made me feel satisfied that i can stand on my own to establish myown business	Nx	56	390	180	14	640	2.58
17	The feedbacks on the practical trainings i get meet my heart desires as entrepreneurs to be	N	101	80	40	27	248	
		Nx	404	240	80	27	751	3.03
18	Feedback on take home assignment enable students stand well in the course.	N	48	69	117	14	248	
		Nx	192	207	234	14	647	2.61
19	Lecturers mark individual assignment and give feedback byreturning the scripts to us.	N	26	26	65	131	248	
		Nx	104	78	130	131	443	1.79
20	Students are given feedback after individual presentation	N	89	28	36	93	248	
		Nx	356	84	76	93	609	2.46
								15.27

The result also shows mean values of 2.80, 2.58, 3.03 and 2.64 for questionnaire items 15, 16, 17 and 18 respectively signifying that lecturers give corrections after grouppresentations, students feel satisfied after feedback that they can stand on their own to establish their own business, feedback on practical training help students meet their heart desires as entrepreneurs to be, feedbacks ontake home assignment enable students stand well in the course.

Questionnaire items 19 and 20 have mean values of 1.79 and 2.46 showing that lecturers do not mark individual assignment and give feedback by returning the scripts to student.Students are not given feedback after   individual presentation

Discussion of the Findings

The mean values of 3.28, 2.94, 2.92, and 2.64 for questionnaire items 1, 2, 4 and 6 respectively have mean values above the criterion mean of 2.50. This signifies that students agree to a great extent that lecturers

give departmental course outline before teaching; teach their courses by linking their concepts to real life situations; teach simple area of course content and difficult aspects given as assignment; and guiding students in acquiring relevant entrepreneurial skills.It is appropriate for lecturers to give departmental course outline before teaching for students to read ahead and to know the extent of coverage of their course outline. The students' response that lecturers teach their courses by linking their concepts to real life situation showed that lecturers engage students in practical work.Givingdifficult aspects of course outline as assignmentan guiding students in acquiring relevant entrepreneurial skill reveal that lecturers engage students in practical work which is in line with the curriculum stipulation. The result is in support of the definition of entrepreneurship education by Candida (2013) that entrepreneurship education is associated with the concept of practice which relates to the acquisition of skills, knowledge and mindset through deliberate hands-on action based activities that enhance entrepreneurship performance. Giving students difficult aspects of the course outline to do as assignment leads them to critical thinking which enhances their initiative, hard work and innovation which are attributes of an entrepreneur.

Questionnaire items 3 and 5 having mean values of 1.63 and 2.25 are below the mean of 2.50. and this signifies that students disagree that lecturers engage them in practical work outside the school and thatthey do not cover the entire course content. Students reporting that lecturers do not engage them in practical work outside the school may be because of high lecturer-student ratio.

The mean values of 2.91, 2.66, 2.83, 3.12, 2.90, 2.67, 3.02, and 2.81 for questionnaire items 7, 9, 10, 12, 13, 14a, 14b and 14e respectively are above the criterion mean of 2.50. This suggests that students strongly agree that lecturers give enough assignment so as to cover enough course outline; use quiz to achieve content coverage, use activity-oriented practice, practical work and take home assignment and end of semester examination for grading.Students responding that lecturers use enough assignment, quiz and practical work to assess them to cover enough course outline showed that lecturers use suitable assessment strategies to assess their students. This is in line with the standard for continuous assessment. Assessment of students using action-oriented activities is in line with the recommendation of the curriculum. Assessing students through take home

assignment during the course of training shows that lecturers monitor closely students' progress through formative test which is one of the stipulations of continuous assessment. Lecturers use take home assignment and end of semester examination to grade students. The grading based on the above mentioned assessment techniques are suitable to contribute in the development of science and technology. It is surprising that students' response on the use of practical test to grade them is approximately equal to grand mean value, showing that lecturers' use of practical test for grading is relatively high. Questionnaire items 8, 11, 14c and 14d having mean values of 2.44, 1.84, 2.54 and 1.73 respectively, are below the criterion mean of 2.50. This indicates that students disagree that lecturers give objective tests to give enough information about the course, focus their assessment on theoretical based testing; use oral test for grading. It is unfortunate that students disagree that lecturers use oral test in their grading. Oral test is very important in the development of student's social attitude which is one of the attributes of an entrepreneur.

The mean values of 2.80, 2.58, 3.03 and 2.61 for questionnaire items 15, 16, 17 and 18 respectively are above the criterion mean of 2.50. This result suggests that students agree that lecturers give corrections after students group presentation; students after feedback feel satisfied to stand and establish their own business at the end of the course; the practical training they get meet their heart desires as entrepreneurs to be and take home assignments enable them stand well in the course.Lecturers use of group assignments lead to development of leadership skill which is one of the attributes of an entrepreneur that entrepreneurship education tries to inculcate in students. Both lecturer/student feedback lead to students competence in their area of specialization. This result is in line with the statement of Iba (2009) that both small and medium scale business fail not because of lack of fund but because of lack of professional acumen. That acumen is the necessary success skills which entrepreneurship studies are set out to impact in the student. Questionnaire items 19 and 20 with mean values of 1.79 and 2.46 are below the criterion mean of 2.50. This result suggests that student disagree that lecturers mark individual assignment and give feedback before returning the scripts and students give feedback on individual presentation. This result indicates that lecturers neither mark individual assignment and give feedback on them nor give individual feedback after presentation. This result also may be as a result of high

lecturer-student ratio which makes lecturers neither mark individual assignment nor give feedback on individual presentation.

Implications of the findings

The result of the finding has far-reaching implications:

1. Teaching departmental courses by linking their concepts to real life situation implies thatlecturers use concrete instructional material and activity oriented practices are used in guiding students to acquire relevant entrepreneurial skills.

2. Giving students difficult aspects of the course outline to do as assignment implies that students are being exposed to beinitiative and critical thinkingfor problem solving.

3. The result implies that lecturers assessment strategies are in line with continuous assessment stipulations that various assessment be done on students.

4. The result showing that lecturers give correction on group presentation and not on individual assignment implies that group take-home assignment expose students to leadership attitude which is one of the attributes of entrepreneurs and for sustainable development of science and technology.

Conclusion

The result of the study shows that the lecturers adopted teaching and assessment strategies contribute greatly in sustainable development of science and technology in Imo State technology-oriented tertiary institution. This is shown by their use of varied teaching, assessmentand feedback strategies in exposing students to entrepreneurial skills and attitudes.

Recommendation

This study has the following recommendations:

1. Since teaching in science and technology ispractical oriented,lecturers are advised to put more efforts to improve the students' ability to stand practically on their own.

2. Since objective test help to cover enough course content and give much information about the course, lecturers should devise means of integrating this assessment strategy when assessing students.

3. Government should employ more lecturers to increase the low lecturer-student ratio which impedes individualized instruction. This will help lecturers pay more attention to individual assignments and feedbacks.

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