

# Faculty Methods of Teaching Science to Undergraduate Girls Students in Najran University Focusing on Independent Learning Process

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## Abstract

Most scientific process require students with skills and knowledge such as critical analysis, data interpretation, problem solving, collaborative work, oral communication, scientific writing and experimental design. Unfortunately, most of the science college departments have a weak curriculum design for teaching and learning science undergraduates students with a traditional teaching learning methods. However, the results show that teaching students of science with early skills and self-learning may enhance their understanding of science contents. The research show how science teachers spent more time on teaching their girls students in Najran University, Saudi Arabia, traditionally with no enough time spending on teaching skills due to their lack of facilities and supplements. In addition , they are engaged in other duties in the colleges beside the need to cover their content of science curriculum. To encourage faculty to address these issues, we need to provide some methods and materials for teaching science with developed and modern techniques to improve students learning and self-learning process. The study is based on students' learning focusing on scientific process of learning science and their perception about the way the course of science were taught with no focus on the content itself. Finally, the study recommends an implementation of teaching course to undergraduate science students with process of skills and knowledge to improve their retention of science which enhances science knowledge and practices.

**Keywords:** science teachers, self-learning process, effective teaching and learning process, students critical thinking.

## Introduction

Usually, successful undergraduates science models and progress could that makes students able to solve problem in various science context and think like scientists (Coil, D. et al., 2010). In addition, science students could improve their learning skills of scientific process by working on data interpretation, problem solving, critical analysis, collaborative team works, monitoring and organizing their self-learning process.

In science career fields, students need to prepare themselves for future job by early learning process in college by enabling students to organize their science content effectively and retrieve their skills and knowledge with less effort. Science process skills could be defined as the process which could help the learners to gain the same skills that faculty use to think like scientists (Coil et al., 2010). Therefore, students need to have an opportunity to practice their data experiment, analysis, using of Instructional and communicational technology (ICT), visualization and observation to gain their knowledge and skills. Thus, this study focuses on the case that teachers of science could support their students with teaching science process and the differences that the students they could get in knowledge with content and process of students' self-learning and process. Furthermore, the study focuses on the materials and methods of science that teachers could use and have to apply their science process skills into undergraduates curricula.

Science skills process can be encouraged by students' self-learning which originally emerges from the field of adult education in their learning workplace. Therefore, this case study is presented to investigate how learning is used in practice, focusing on factors that affect its use and how it is evaluated by students and their teachers. They perceive a successful teaching method and learning process to develop science skills. Finally, the results of the case study are discussed and certain suggestions and implementations for future research are presented.

## Literature review

Many research on science education process shows attention to and debates about undergraduate students' involvements in problem solving, critical thinking, self-learning using of science teaching and tool that encourage students' with effective learning process and skills. They also focus on how students' discover

knowledge and experiences and transfer them for future implement. Therefore, this study will focus on the main issues that encourage learning environment with a successful process in scientific fields.

### **1) Undergraduate science process**

Most of science teachers encourage their students to focus on their science process skills and methods such as experimental design, problem solving scientific writing, oral communication, using of ICT, making teamwork as well as data interpretations. However, most of the science colleges lack modern methods for students' learning in science curriculum for teaching undergraduates skill which affect their understanding of science process skills (Coil et al., 2010). Teaching undergraduates science programs successfully means making students' able to "think like scientists" (Handelsman et al., 2004).

### **2) Encourage students' active learning**

Undergraduate students could be more active and effective through their learning by explicating instruction of science process skills which could help students' activities and acquire a repertoire of science process in the early stage of the college curriculum. In other words, it will fulfill and promote students' interest in science content which would help them to develop scientific process skills (Alshehry, 2009). In addition, the advantages of active learning process are to promote inquiries about active construction of knowledge. Therefore, this study will show the important teaching and learning of science in their different ways such as problem solving, practical work, critical thinking and self-learning.

### **3) Using educational technology and relationship between students' and teachers in evaluating each other's**

According to a recent rhetoric in Saudi Arabia presented by the ministry of economic and planning, 2007 and the ministry of higher education, 2007, these factors that affect the learning of science " asserts the need intention to develop these areas as part of the country's efforts to maximize the benefits derived from advances in science" (Alshehry, 2009). However, this section shows how students' interact to work to be an active learners by for example, taking notes while reading their science textbook, drawing models of concepts, creating and exploring questions to be answered regarding their science content and processes (Coil et al, 2010). Using the new technology methods within the context will show how new questions to be posed and new approaches designed. It also will increase the attention "within the biological sciences and attention to its societal context, the growing complexity of the data generated and the need for computational and modeling skills to deal with complexity" cited by (Woodin et al., 2010). Using new technology in teaching of science content could be achieved through the interacting with web, emails, memos, spread sheet, digital video tools, PowerPoint presentation (Collins & Halverson, 2009 cited in Smith 2011). Therefore, the use of instructional technology (IT) during the teaching of students could bring the real world to them and grasp meaning better which can also making their learning enjoyable and exciting (Alshehry, 2009).

Using traditional methods of teaching and learning science will not affect students' chances to examine ideas and concepts through exploration modeling and experimental methods (De Haan, 2005). Regarding students and their perceptions of science teachers, they need to provide their attitudes enjoyments and motivations towards science teaching and how to improve their learning of science through surveys and questionnaire provided. According to Zaiton (2004), evaluating the science curriculum and teachers' works would provide the negative and positive points in teaching of science which could improve and encourage the curriculum of science content and teachers' achievement in the future.

### **4) Problem solving in practical work**

This section will show how students are structured to work to be an active learner by "taking notes while reading their textbooks, drawing models of concepts, and creating questions" which could indicate hour by hour activities for each student working on problem solving (Coil et al, 2010). In problem solving, gaining by students' practices needs students to focus on specific skills such as data collection, data analysis, hypothesis formation, computing and information literacy, which could lead students to a greater independence of work and thinking readiness for new challenge, growing self-confidence, and a sense of accomplishment (Harrison et al, 2011). Therefore, a various of writers explore numbers of impact of practical work as the way "to *apply and test ideas and to facilitate conceptual learning*" and to solve scientific problems (Alshehry, 2009). In this respect, students need to understand the nature and practice of science (Harrison et al, 2011).

### **5) Teachers and their students interaction in teaching and learning of science**

Using traditional methods in teaching students science will lead to document students' learning gains in conceptual learning. Teachers need to encourage their students to learn scientifically by making a sense of

resources in teaching science will provide the benefit of getting involved and engaged to provide a high quality of teaching and learning of science (Louis, 1998)

We could conclude from all above that students' curriculum and methods enable students to think about their learning needs by their own words, and also select their learning tasks that meet their current needs.

### **Present study**

To investigate the use of effective learning of science process and skills, a case study with 10 students was conducted in the domain of learning of science. A mixed methods approaches were used to collect both quantitative and qualitative data from students and their teachers. Collected data were taken to reflect: a) the actual teaching of science, b) the students' and teachers' perceptions of teaching and learning of science as well as factors that influence its use, and science process and skills perceived successfully to develop and improve science process.

### **Research questions**

In order to understand students and teachers perception about the context of biology, this study draws a source of data which include: 1) faculty (field notes gathered from planning interviews and written course reflections). 2) individual students (interview, written courses evaluation, scanned copies of exams, and students grades) and 3) classrooms data (exercise from lectures and active engagement). All of the data sources in this study discuss and analysis students' perception and expectation are selected from individual students' interviews. A more complex analysis will be presented in later publication gaining different data from different activities, group discussion and data from students home work would improve students' perceptions of the course skills and biological knowledge. These data were provide a rich active learning in the classroom, with more investigation about how students deal with learning and their teachers' interaction. Thus, study were focused on students' response to the science course and how they participate with teachers effectively. In addition, more analysis in interview data were selected to investigate students perception about learning science with providing an ideas about what/how learning of science mean to them. Therefore, this study investigated the students and teachers perceptions, expectation and attitudes that could influence their perception reforms and how participation in the classrooms.

The following research questions were asked to guide the present research:

- 1) How far students' and teachers make use of ICT?
- 2) How far in the interaction between students' and teachers in learning science?
- 3) How far the chance, are given to students to solve a problem during the class?

### **Selection of data**

We collected data from eight teachers as a faculty of depending interview (writing notes). In addition, eight undergraduate biology students form the College of Art and Science for girls in Najran University were interviewed. Students ranged from different levels of science (biology) major to get different perceptions varying from teaching and learning of science stages to stages. The interview process lasted usually between half an hour to one hour and it was written as notes with students' permission. Then, the interviews were transcribed and translated English language as a theme with difference of students' perceptions. The coded interviews were presented concerning the nature of teaching and learning science process, for example, what students should learn or think to learn successfully and what they need to do well in the course to improve the learning?. Once the thematic framework was established, it was filled out with interpretive notes, linking the interview quotation to relevant references of the literature.

Particular concern were paid to students' thought positively about the class activities, homework, teamwork and exams to get a useful understanding in learning of science. After that, themes were emerged from instances codes to provide evidence of perceptions, expectations and approaches a cross students' attitudes. Also, that data were documented by observing students and how they were doing well in class. Thus, the data were taken from two types of samples among students and teachers (S & T) for this research in order to strengthen the investigation of the teaching and learning environment by allowing a wide range of teachers' experience and students' attitudes.

### **Pilot study**

A pilot study was carried out to test and develop interview structure and reveal problems that could face the research. The interview questions were conducted with three experienced teachers that had to be in the same colleges to those participants in the final study to ensure sample that work be comparable experience, knowledge

and way of thinking. The corrections of meaning were made on some of the questions according to their easy understanding of meaning to be present in the real study.

## Data analysis

This section is divided into three subsections. Each addresses a particular students' perception that the researcher observed in the interview data. Each section concentrates on some specific instances when students interview discussed their perceptions and attitudes and how those perceptions influence their class activities and teachers interactions. In the concluding section of this paper section, the researcher will clarify that students' perception and expectation can be changed and have implications for instructions and science educations.

## Findings and discussion

### Part 1 : Academic teachers (lecturers)

#### 1.1 Using of ICT

Most of teachers (about 80%) refer to the use of traditional methods in teaching whereas about 20% refer to the use of IT such as PowerPoint, computers, visual aids, and slides that were shown on a microscope with sample. However, they accept the use of traditional methods. Whereas, all participants say that presenting of facilities and supplies is lack to be presented in classes that only computers and project applied in lab which they ask to present more technological supplement in class and laboratories beside the aids methods that support the teaching of science.

#### 1.2 Relationship between students and teachers

All teachers notify that students are satisfied with the use of traditional methods. Teachers can integrate students in class supporting independent learning (IL) by general activities, discussion and presenting experiment. The need of practicing them beside training, for example, IL can be encouraged according to interview by using electronic site to search and present some papers. According to the focusing on students' independent learning in their teaching, one participant (L5) says: ***“cooperating learning during classes and let the students to search by their own way of learning, let them contact me if they are only in need to me and have any question or concerns regarding searching on scientific issues”***. This way of teaching let the students as Handelsman et al. (2004) noted to be able to think like a scientist by giving them a chance to search by themselves leaving the teachers task of teaching as a guidance or a director when the students need them. Another lecturer (L3) also says: ***“I usually encourage my students and support them by presenting some websites references that could support their lecture before it presented to remember their lecture subject”***. This study realized the importance of the using students an instructional technology (IT) such as searching of some references on the website to find the information they need in their study. It reflected the need of teachers to encourage their students to learn scientifically and getting them involved in their teaching to provide them with a high quality of teaching and learning of science (Louis, 1998).

#### 1.3 Problem solving in practical work

Regarding the students' focus on IL to solve a problem and the way it supports students learning, most teachers stated that this could be achieved by doing some of the brainstorm, notifications card, exercises, discussion and students interaction. Also, they supported giving small quizzes for students to motivate them to study frequently. Also, as one teacher (L3) says: ***“a small project during the term is very important to enhance their self-confidence and their future learning when doing their higher degrees”***.

Whereas other lecturer (L6) also defines the importance of research project as ***“it gaining off all what students study during the term, help them to find enough references for the science concepts”***. Therefore, doing some practices as what stated before according to the interviewees perceptions such as doing some research project collecting and analysing some data, computing and information literacy could lead students to a greater independence of thinking with a new challenge, growing self-confidence, and a sense of accomplishment (Harrison et al, 2011). Regarding the importance of practical work, lecturer (L8) show that: ***“students are always excited to know the results after each experiment to practice them in their real phenomenon”***. This perception shows the importance of practical work in the scientific field that enable students to the touch, recognize and see thing during the laboratory experiment into the real life (Harrison et al., 2011).

### Part 2: students

#### 2.1 Using of ICT

Strongly, most students welcomed the use of ICT, which are used everywhere to help them to interact with the teachers. As one student (S7) mentioned that: ***“using the instructional technology IT helps me to interact with my teachers and understand the lecture positively”***. Regarding the sources used, most of the students

mentioned that there is a lack and difficulties in providing the facilities that (S3) mentioned: ***“we need to make and provide more supplement in technology and quit the traditional methods used”***. To support the traditional methods that only have been used by the teachers during the class, one student (S4) realized that: ***“the teacher is only the sources for the information we get during our study”***. Students in this case show the need to employ them with other resources of information such as libraries to support them to save teachers’ time and leave them when they need a guidance and directions. This result agreed with other studies and stated the need to promote students independent learning to encourage them in the learning process more actively (Alshehry, 2009). To support this, students need ***“a big library with all technological supplement to enable students to search and expand their knowledge, laboratories for students with computers”*** (S7).

## 2.2 Relationship between students and teachers

Students could present their experiments as mentioned by most of students (S2,S5, S7,S8.) ***“discussion methods, questioning marks, present research, discuss some specific subjects, present some essays and explaining it to enrich information”*** (S5).

Student could however, interact with their teachers by presenting some visual aids to make an expecting of lectures more clear to students. Furthermore, by using of discovering films for the scientific documentations and make some questions to be discussed after that. Grouping students in classes also enrich students with information related from outside, getting them a new idea of thinking that could benefit each other. All of these methods used reflect the study of Coil et al. (2010) regarding the science content and process used in the teaching and learning of undergraduate students.

## 2.3 Problem solving in practical work

Teaching methods used to solve problem in classes are training, practices, discoveries and using of new experiment

***“to make information more stabled and not forgetting, also to connect the scientific phenomenon with the technical sides”*** (S1).

One other student says: ***“the laboratories are the scientific environment for students that make the science more understandable for the future science study planning”*** (S3). As Harrison et al. (2011) noted that laboratory gives students a sense of self-confidence, critical thinking and a sense of accomplishment. Even though, there is a need for the use of the laboratory work, there is a lack in the resources and supplement used. ***“we need more resources, facilities and supplement in in the laboratory classes encouraging us to work on out experiment more successfully and actively”*** (S4). It also could ***“move students from the traditional methods to practice and enable them to recognize the information in real”*** (S7). One student mentioned a very famous Chinese wisdom that: ***“we forget what we hear, can’t remember what we see, but could learn what we do by our hands”*** (S4). Therefore, the results indicated the need of providing the supplement in the biology laboratory, in which there is no supplement and lack of instrument to support experiment as students mentioned.

## Conclusion and Recommendation

These findings of this article show the perceptions that reflect teachers/students understanding of teaching and learning by the methods of using ICT, relationship between those staff and their students and the problem solving by students during the class. The focus of this research on teaching methods in science within Saudi Arabian higher education for girls could make the findings important because of the need to improve and develop the teaching methods used for girls in Saudi Arabia. This study, however, show that science teaching methods used for girls college are still mostly dominated by lectures (traditional methods), which are not in line with the current developments in science teaching and government’s intention to encourage students independent learning and critical thinking to provide a new inquiry and problem solving opportunities. In addition, the findings of the study revealed that the teaching of science in Girls College is affected by the facilities and supplement presented to the students during the class with a strong need for students to practice their science phenomenon during the laboratory working on their touchable experiment. By showing teachers’ practices in this study, most of the traditional methods used reflecting some circumstances that the teachers faced such as the lack of supplement and resources, lack of time and classes size. In practice, the science teaching methods used in this study were predominantly traditional and teacher-centered taking the form of lecture or presentation during the theoretical and laboratory classes. Regarding the promotion of independent learning, most of teachers adopted methods conducive to learning independently by for example, group discussion and preparations of materials presented in class. Finally, students may not always understand goals or values of learning that goes beyond traditional methods or memorization. They need to be supported by independent leaning and critical thinking.



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