

emailed submission

by Elsiddig Eldaw Ibrahim

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ACTIVE LEARNING IN ENGINEERING
CLASS ROOM

Written By

Elsiddig. E. Ibrahim (2024641)

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Lecturer: David Williams

ABSTRACT

Teaching and learning are the most important factor of judging teachers and students performance. Hence, active learning is an approach that has been used to improve students' ability and understanding of any module, without depending completely on their teachers'. This assignment sets various methods and arguments to emphasise that active learning is a beneficial approach that enables students to build solid knowledge and better understanding of engineering concepts in classrooms and laboratories. A comprehensive literature review was undertaken to get background, ideas and information about active learning. Hence, previous studies were also reviewed to get other authors' opinions and understanding of active learning. Furthermore, specific methodology was used to achieve the aim, where experimental results were used to proof that active learning encourages students to be active and independent. A logical discussion was demonstrated where evidence, results and arguments were given to withdraw the reader attention to the importance of active learning. Then a short conclusion was written to show the outcome of the assignment.

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1. INTRODUCTION

1.1 Introduction

Active learning is a general interaction between the students and their teachers. However, active learning can be described by a process via it first year engineering students' learning could be judge on how they learn and what they learn. Hence, as a discipline, an opening question in the beginning of the lecture is needed to keep the silence in the classroom, because the students are encouraged to think hard rather than receiving information from the teacher. Nevertheless, many studies show that it is not useful to transmit understanding to students by just following informative style of teaching; instead, teachers need to challenge their students' ability, intelligence and the way of thinking. Via active learning, engineering students can play important role in their learning process; it is also an opportunity for them to build solid knowledge and understanding of the concept of engineering in real life as a result of their teacher challenges.

Basically the theory behind active learning is based on the fact that learners develop their deep level of understanding depending on an existing knowledge, where they will be able to analyse, evaluate and synthesise ideas. However, a rich- head teacher is the one who makes a deeper level of understanding possible by providing learning environments, opportunities, interactions, tasks and instruction that foster deep learning. In this frame work, a social constructivist, Lev. Vygotsky (1896-1934) says learning happens basically via social interaction with others, whether with a teacher or with a group of other students. In addition to that, active learning also should be relevant within a meaning full context; such as people learn best when they can see useful results emerge from their learning and it can be connected to the real world. This idea was developed by the philosopher Jean-Jacques Rousseau (1712-1778). At the end of the day, active learning is all about doing particular activity, encouraging students to engage with their studies whilst, making sure that the learning objectives are more important than the task it self. On the other hand, learning objectives could be achieved if the students allow to be engaged in small-group seminars or collaborative project or could be also achieved better via lecture-style approach.

1.2 Background

In 1916, Dewey suggested that students' engagement in active learning is the responsibility of their teachers to create learning conditions that promote students' educational experiences. He added that learning is a social interaction between the students and their teachers and other students. However, the teacher task in active learning is to create a learning approach that go beyond the transmission of

information to develop strategies that help students to engage with the materials for the sake of their own knowledge's improvement. Hence, previous research studies have shown that active learning, students cooperation's and feedback are among the indicators of students good engagement (Chickering & Gamson, 1987), where students' engagement thought to be the most important factor that leads to better and deeper understanding. Meanwhile, engaging students in learning still a challenge to all teachers, because lack of engagement in large classrooms may cause students' lack of participation in discussion, for example in large classrooms where students are less likely to ask question even though they don't understand the materials, this challenge recently led universities to focus on students' active learning approach instead of the traditional lecture format style (Tagg, 2003). At the same time, feedback (Trees & Jackson) and technology is also recognized as a positive factor in improving students' learning in large classrooms (Roger & Cox, 2008).

In the past many philosophers across the globe have set out the theoretical foundation of active learning movement such as philosopher Dewey (1959) and psychologist Piaget (Gallagher & Reid, 2002). However, some of them claimed that active learning is difficult to be included in-class discussion, case study discussion and academic service learning (Bonwell & Eison, 1991). They also have emphasised that classroom activities fall into passive learning approach such as lectures, and traditional homework, while active learning in engineering education can be described via experimental activities.

In 1991, Bonwell and Eison claimed that active learning is an activities that "involve students in doing things and thinking about the things that they are doing, what does it mean to involve for example first year engineering students in doing things, Does "doing" something require physical activity?, (Mayer, 2004). Astin, 1993; di Vesta & Smith, 1979; Hake, 1998; Ruhl, Hughes, & Schloos, 1987), Emphasised that the notion of which that active learning is beneficial is true.

2. METHODOLOGY

To achieve the aim of this Assignment, a comprehensive literature review will be undertaken in order to allow to gather full information about the topic and get back ground and understanding of the topic. Also a literature review will help to launch a full investigations and to review previous work and state of the arts practises. Hence, experimental data from a surface grinding machine to grind carbon fiber reinforced composite materials will be used, where a thermocouple was used to measure the material temperatures before use it in aircraft manufacturing process.

2.1 Curriculum Design Method

- Students behaviour
- Teaching style
- Environmental factors (equipment, lecture room size, number of students)
- Students are involved in other activity (experiments) instead of listening
- Students are involved in higher order thinking such as analysis, modelling & simulation and evaluation.

2.2 Experimental Example

- *Blending of Composites*

The world growing population and the huge demand of the manufacturing processes products are the main reasons of the raw materials consumption. This issue made it clear that the need for raw materials is a reality. Although there are many materials available for use, but the demand for composites is massive because of its especial chemical and physical properties.

There are many types of composites have been used in the industry nowadays such as concrete and reinforced concrete fibreglass mud building bricks, wood, cotton etc. This experimental work on carbon fibre composites grinding was carried out to analyse the heat transfer phenomena during grinding of composites. Hence, thermocouple was employed to monitor a measurements principles of thermocouple. Figures 2.1, 2.2 and 2.3 showed experiment procedure and composites applications in the industry.

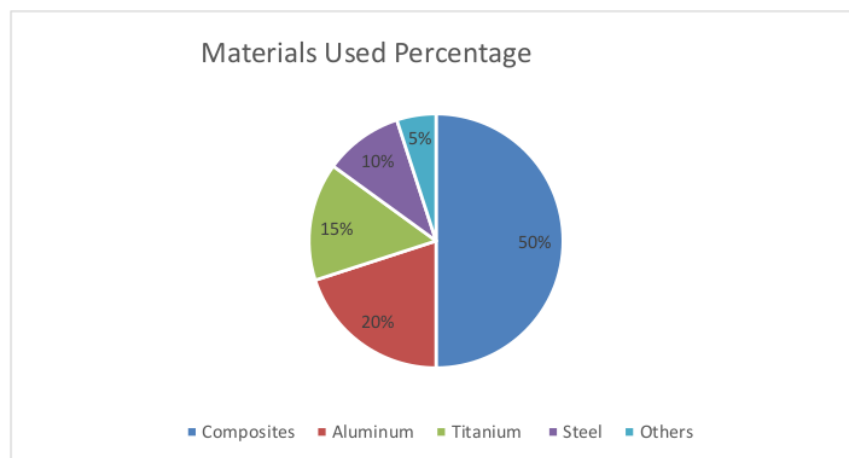


Figure 2.1: Composites Application (Composite use in airframe structure, Micheal C.Y. Niu)



Figure 2.2: Composites Blending & Manufacturing Process

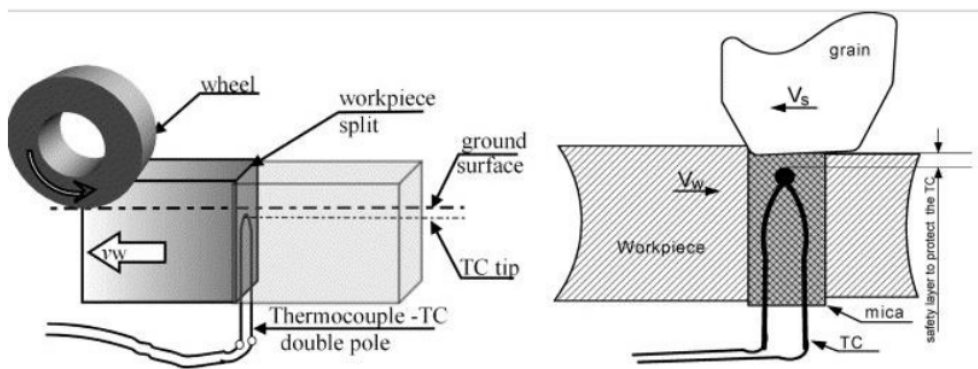


Figure 2.3: Thermocouple Measurement Setup

3. DISCUSSION

It is very important to think about specific limitations to active learning in engineering classroom such as the teacher efforts to evaluate students' performance from year to year or his ability to discover students' ability differences from year to year and also some factors beyond his control to deliver the course in useful fashion style, like something might goes out of his control during a classroom discussion. At the same time these limitations might be unpredictable such as;

- Active learning might provide no standard for judging techniques efficiency.
- Active learning offers ways of improving understanding but the lack of focus might lead to mixed findings.
- Active learning developed basic skills that depend on conceptual understanding of content to promote meaning full learning approach.

3.1 How to bring active learning forward into practice?

To bring active learning forward specially in engineering applications classrooms, it is very important to make a good planning in which students have to be in the centre of that planning and teachers also need to introduce more ideas such as:

- What one has gained from the lecture?
- All activities must be relevant to what students need to be learnt
- Assessment & engagement
- Active learning creates the student identity

3.2 Key Challenges

- Curriculum design
- Students behaviour
- Teaching style
- Environmental factors (equipment, lecture room size, number of students)

3.2.1 Curriculum Design

Skilful planning is very important in active learning approach. For example, the teacher need to consider; what his students are going to gain from his active learning approach, what resources he need to provide and how he is going to assess his students' progress, as he definitely need to use large lecture room to introduce ideas and use eye contact / or give relevant information to address the whole class, while preventing the student not to get destructive due to several factors such as:

3.2.2 Students' Behaviour

Inside the classroom students' behaviour is one of the main problems in active

learning where the teacher might lose control over the class due to the open discussion policy.

3.2.3 Teaching Style

This factor is one of the challenges that should be tailored and adapted to improve students' better understanding of the task. However, there are a lot of factors that determine the type of teaching style that meet active learning criteria such as;

- Skilled teachers provide rich feedback using assessment for learning to help students to understand their current strengths, weaknesses and what they need to do to improve
- Problem with the equipment's in the class room might discourage teachers from teaching well (Computer, projector, heating& ventilating system, sounds and lightening).
- Larger size lecture room and large number of students should be dealt with carefully to prevent lack of students' engagement.
- Active learning approach outcomes have to overweigh other traditional approaches benefits.

3.2.4 Technology

Is also one of the challenges that active learning should be adapted where teachers can use Canvas, Zoom, Mee too, Teams etc.. to give pre- lecture information.

3.2.5 Teaching Environment

Teachers need inclusive environment to teach and also to make impact on learning outcomes via;

- Efficient engagement
- What is important in the lecture?

4. CONCLUSION

There are several activities that could be used to explore active learning in engineering classroom, among them good planning, feedback and observation, for example like observing a lesson taught by an experience colleague, and at the end of the session reflect on what went well? Why did it go well? Were there things which did not go well? Why do you think that was? Use a reflection worksheet to keep your observation record. On the other hand, think about how you could make changes next time to bring active learning features into life, think about what you are going to introduce into your planning for the next academic year. What would you say to convenience other academic and colleagues about the benefits of active learning approach. Evidence from previous studies proved that active learning is beneficial although there are many challenges and criticism from opponents.

5. REFERENCES

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6. Appendices

Materials used In 787 Air Plane Body

Materials	Percentage
Composites	50%
Aluminium	20%
Titanium	15%
Steel	10%
Others	5%

Table 1

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GRADEMARK REPORT

FINAL GRADE

/100

GENERAL COMMENTS

Instructor

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