The Questioning Learner

Ben Mhishi

July 2015
url:

Keywords: Engineering, electrical engineering, Inquisitive, questioning, problem solving, further education

Context

The research was undertaken in a Further Education (FE) institution's engineering department. This researcher is a lecturer in this department and specialises in electrical engineering units. The study focused on five learners of varying abilities in Level 3 year 2) see relevant characteristics in appendix 1). Explicit consent to participation in the project was given, thus meeting research ethics.

The 'problem' or issue you have addressed

Learners leave educational institutions with qualifications and yet they are weak when it comes to solving real world problems. Success in any engineering pursuit often involves the ability to understand problems, break down complex situations into basic constituents and apply fundamentals. Gadd (2011) mentions 'similarities, overlaps, and patterns', in other words, a mastery of principles should put learners in good stead to recognise these patterns; that is, which principles to apply.

Consequently, I chose to focus on a final year group, in order to develop this key skill. My intention is to influence the type of questions that learners ask; more specific and profound. For instance: ''How do we know that this is so..?'', ''What evidence supports this.. .'' and so on.

Learning should equip learners with a stable base from which new situations can be tackled. Perhaps this in essence is the purpose of education, to enable learners to apply knowledge to real-life problems-which are often unfamiliar. Allow me to suggest that past proficiency in assessment is not necessarily a good predictor of this skill.

Review of current practice and literature

The current instructional practice in FE is assessment based, essentially a tick box exercise focused on teaching learning outcomes. Fundamentals take a back seat, as long as learning outcomes are covered and learners achieve. This is to the detriment of the engineering future and the quality of employee that we deliver to the market. Evidently, employers are

left with no choice but to look elsewhere, and yet year on year we continue to churn out 'engineers'. According to Dweck (2006) the human mind is malleable hence something can be done to redress this key engineering habit.

Merrill (2002) discusses first principles of instruction which involves: demonstration principle, application principle and so on. Adapted to engineering, this can only involve a thorough learning of engineering principles followed by application.

My Research Question

Will learners develop an inquisitive, curious and questioning attitude if taught from first principles and thus be able to apply knowledge to new situations?

The Project

Research

At the onset of the intervention learners completed a questionnaire which enabled the researcher to form a baseline from which to gauge progress. This lecturer has been with this group for over a year hence it can be concluded that he is now fully conversant with the group. Data was also gathered from lessons and assessments 'professional judgement', in addition, focus group interviews were conducted.

Action

There was a deliberate focus on engineering principles and their applications. Connect activities focused on theory timeline and history. Here, learners can be taken back in time, delving into the mind of theorists and the problems they encountered before proposing solutions. Prior leaning before lessons involved investigating theories. Engineering problems were broken down into basic constituents with a strong emphasis on associating engineering theories to certain problems. Learners were presented with challenging problems to test application of learnt knowledge to new and challenging problems.

Assignment feedback targeted stimulation of the inquisitive process.

Findings

The Questioning habit increased: Analysis of appendix 2 data shows that questioning habit increased. Learners started asking the 'right' questions. By the end of the intervention all learners rated their questioning skill at 3 or above. During structured interviews learners said a grounding in basics empowered them to be able to ask the right questions.

Assignment standard improved: Evidence of improved problem solving skills in assessments. In essence engineering literacy improved, an awareness of principles of

engineering was shown. The approach to problem showed that engineering principles had been used to generate ideas and select solutions. Thus solutions were arrived at after careful thought.

Punctuality improved: Learners arrived on time for lessons, one learner said that they would feel '*left out'* (structured interviews) should they miss the beginning of lessons were the fundamentals are usually covered.

Learner engagement

Surprisingly learners said they enjoyed being challenged academically. In addition, the application of learnt material to real world problems gave them a sense of purpose. Thus their education had a purpose. Learners stayed on task and learning actually happened.

Lessons Learned and next steps

A habit is an acquired behaviour that needs deliberate moulding in order for it to become second nature. In other words more time is required to fully influence and develop engineering habits of the mind and hence create young persons who 'think like engineers'. Indeed these habits can be acquires through deliberate targeted practice.

Moving forward, these engineering habits should be embedded into the engineering curriculum for them to be effectively developed. Thus the scheme of work should be annotated with activities targeting specific habits.

The project team should stick at it, the initial foray looks promising. In my opinion learners should be followed into employment with the view of getting employer feedback. The research started in response to skill shortage hence it is only appropriate that feedback from employers should continually be sought to check for intervention impact.

References

Dweck, C. (2006) *Mindset: The new psychology of success.* New York: Random House

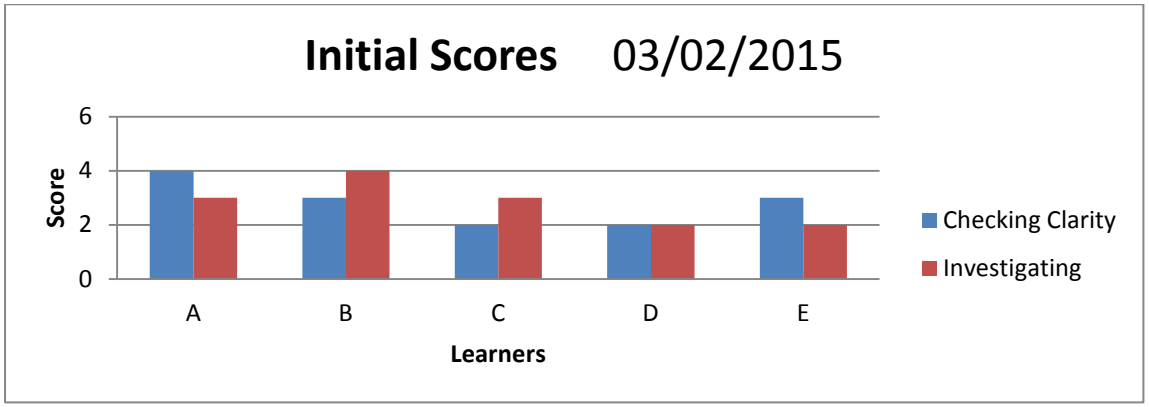
Gadd K. (2011), *TRIZ for Engineers: Enabling Inventive Problem Solving*,: John Wiley & Sons

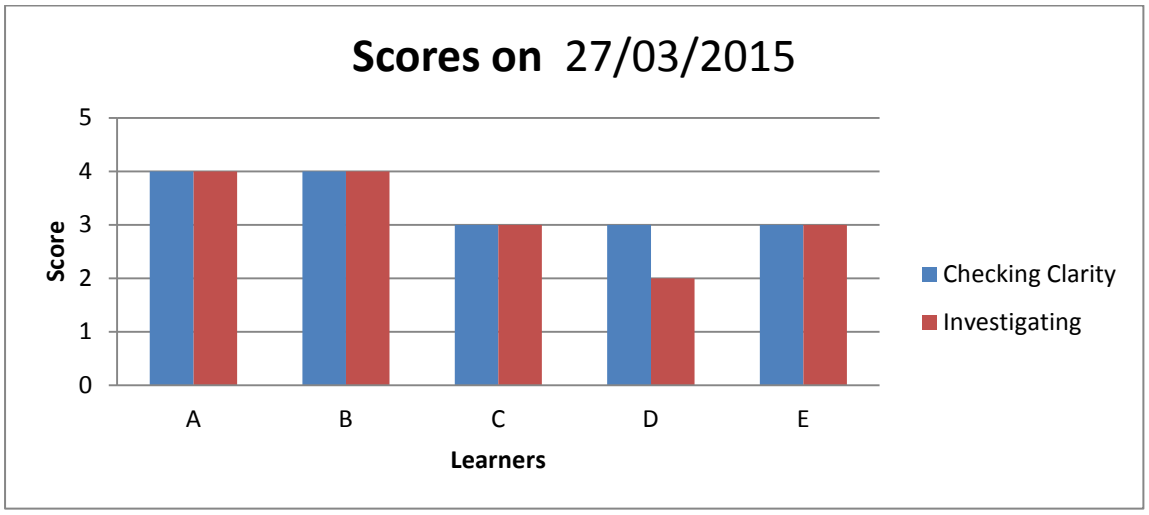
Merrill, M. (2002), *First principles of instructions, Educational Technology Research and Development*, 50(3),

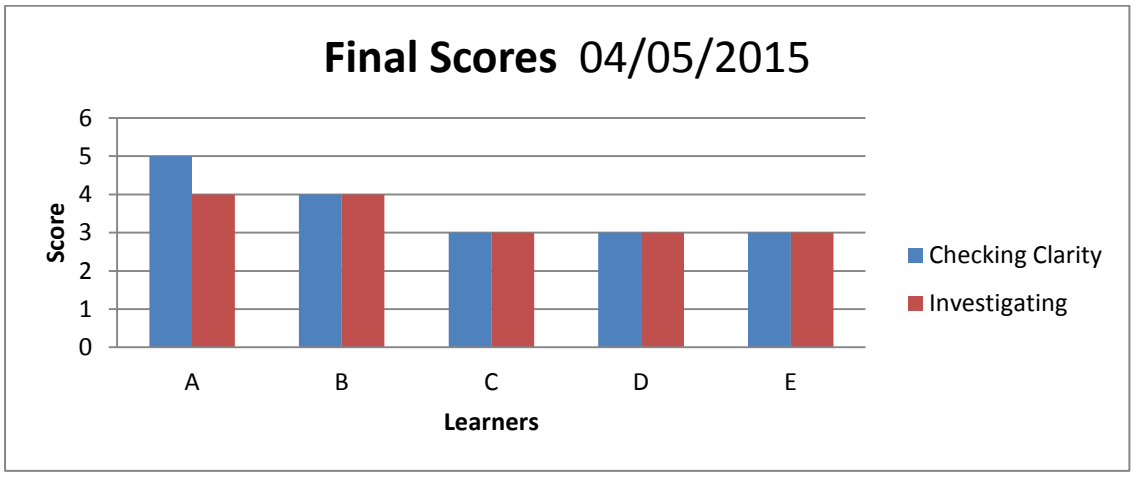
Appendix 1 Learner Characteristics

Learner	Ability 1-5 (1 less able to 5 Based on YR1 Results	Age	Unit
A	4	22	Further Electronic Principles
B	3	17	Further Electronic Principles
C	2	18	Further Electronic Principles
D	3	21	Further Electronic Principles
E	4	24	Further Electronic Principles

Appendix 2 Results: Questionnaire Scores






Final Scores 04/05/2015
Score
6
5
4
3
2
1
0
A
B
C
D
E
Learners
Checking Clarity
Investigating