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Barnett, J.E. & Francis, A.L. (2012) Using higher order thinking questions to foster critical thinking: a classroom study, Educational Psychology, 32:2, 201-211, DOI: 10.1080/01443410.2011.638619

1. Aim and Rationale/context of research.

TThe study set out to explore how utilising higher order thinking (HOT) quizzes within subjects could help develop critical thinking (CT). The study proposes that if teaching includes HOT quizzes then there will be significant improvements in CT and general subject knowledge. Renauld and Murray (2007) suggest that teaching HOT questions is associated with an improvement in general critical thinking ability. The purpose of the study is to contribute to the empirical data that already exists.

2. Participants

The sample was conducted with 147 university students. The students all had informed consent and were predominately white females. The design featured 3 groups from pre-existing classes.

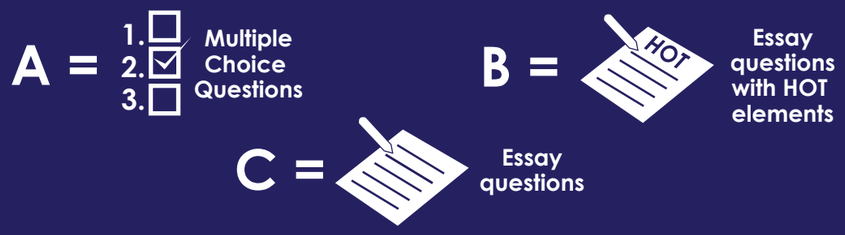
3. Background

Employers have an increased desire for critical thinking skills (Hart research associates, 2010) and a failing of higher education is that they are not taught properly (Bok, 2006). However, the time and effort that goes into preparing a successful programme of study can put off many teachers (Gray, 1993).

4. Design

- The study is of a classroom based, quasi-experimental design.
- The educational course was split (by classes) into randomly assigned test groups. The instructional methods and classroom management techniques were kept the same. **This helped to reduce threats to internal validity.**
- Group C had two x 75min lessons with four long tests and groups A&B had three x 50 min lessons each week with five shorter tests. Different format for delivery of testing was applied (See: **Group testing methods below**), some designed to use HOTs. The HOT quizzes were graded based on the effort the student had demonstrated.
- The Watson-Glaser CT appraisal was used at the start and end of the study **(This appraisal is well established, cited 842 times).**
- The immersion method, effort based grading and minimal feedback were given in order to reduce work load on the lecturer.

Group Testing Methods:



5. Findings

- Significant improvement in critical thinking were demonstrated by all groups. However, no significant differences were shown within the different test groups.
- Data was presented within a table that shows results from the Watson-Glaser pre-test/post-tests, along with the results from the classroom tests. In order to make analysis easier, numbers for tests were converted to percentages. It was found that the results parallel those of Renaud and Murray (2007, 2008).
- Although the study did not show a clear link between HOT and CT it did show an improvement within the subject knowledge of students.
- It suggests that HOT enable students to engage with a subjects at a deeper level, helping the information to be retained, this data suggests that HOT-based questions will help the students learn.

Critique: Limitations

- A clearly positivist approach was used to gather data, however, using a mixed-method, qualitative approach may have shed some light on whether the students were less engaged or had perception of low standards by gauging their opinions. (Punch & Oancea, 2014, p4)
- There are a number of aspects of the study that were not ideal and may have affected the research:
  - There was no randomised treatment to the study, this may have caused some issues with the internal validity. (Punch & Oancea, 2014, p270)
  - There was no 'untested' control group included within the study and therefore it is not possible to tell if the improved CTs were from the testing measures or from other sources. (Punch & Oancea, 2014, p260)
- The immersion approach many not be an effective way of testing CTs and that effort-based grading system may have led to lower perceived expectations and less motivation. (Figlio & Lucas, 2004).
- The minimal feedback approach may have additionally hampered student engagement (Winne & Nesbit, 2010).
- The longer tests and longer lessons create a variable that may have skewed the results for group C. There is a chance that the longer activities could have caused students to lose focus/ concentration. (Punch & Oancea, 2014, p286)
- Effort based grading does not demonstrate how well students have used their higher order thinking skills just how hard they have worked, therefore it is unclear how successful they have been with this aspect of the quiz by using this instrument. (Punch & Oancea, 2014, p294)

Critique: Positives

- The study has a clearly set out structure and utilises clear sub-titles to outline the different aspects of the study. Clear goals are well identified in order to establish a well developed theme. (Punch & Oancea, 2014, p30)
- The study has a clear, pre-determined testing process which are measured using the established and recognised Watson-Glaser and Bonferroni tests. (Punch & Oancea, 2014, p295)
- Findings supported by referral to others' work and there is consistent and extensive referencing throughout the article. The study repeatedly backs up its findings through reference of a range of other studies. (Punch & Oancea, 2014, p126)
- The study comes across as very impartial. They have an initial hypothesis, however throughout the course of the study it is shown that this isn't fully correct and the study accepts and explains the reasons for this. Even pointing out flaws within the study itself. It goes on to suggest that the chosen approach may not have been the most successful. It does go on to outline how other techniques might be more successful in the future. (Punch & Oancea, 2014, p310)
- Grading of results was all done by the same instructor and then students given the opportunity to self-assess against the marking rubric (Cohen et al, 2007, p344).
- The study was published within a peer-reviewed journal (Educational Psychology, Routledge) and has been cited 19 times. The lead author is regularly conducts research and has been published 14 times (Cited 143 times).
- Similar studies to this were completed by Renauld and Murray (2007, 2008).
- The study was designed to reduce workload on the lecturer, making it more representative of classroom teaching in which reduction of work load is always desired. (Gray, 1993)

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