

COGNITIVE ACTIVATION IN MASS LECTURES THROUGH VOTING SYSTEMS IN THE LECTURE THEATRE

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Abstract: Communication plays an important role in life and especially in education. Nevertheless, most universities have to cope with large numbers of students. Therefore, many introduction courses focus on ex-cathedra teaching. Nowadays, we know that the learning success is limited by such a teaching method. In this paper, I would like to analyse the effects of a new e-learning-tool prepared for large lectures. This new interactive teaching technology allows students to interact with each other even in huge crowded lectures. This paper will compare the learning success of two different teaching methods based on the so-called peer instruction.

1. BACKGROUND AND AIMS

As we have known for some time, frontal instruction in mass lectures is ill-suited to conveying new knowledge. This is confirmed by current neuroscience research on teaching and learning processes (Günther, 2012). Yet most universities adhere to mass lectures. Surprisingly, the issue finds little resonance even in current debates on higher education didactics. Have we given up hope in the face of the sheer numbers of students in mass lectures, which render a teaching discourse or group discussions practically impossible? Have we accepted that the lecturer's role in such situations can only be that of a reader, and the students are merely passive consumers?

We must not rush to affirm these questions since methods for the cognitive activation of large audiences do exist. *Eric Mazur's* (2013) 'peer instruction' teaching method achieves interactive learning and the activation of large student bodies by encouraging the students to independently recognise factual mistakes and to help each other to correct them. Thanks to electronic voting systems in the lecture theatre, peer instruction can be integrated into mass lectures without consuming a lot of time.

The question remains, though, how exactly such a method is to be designed so as to achieve the best possible results. This issue will be examined in detail in the following.

2. METHODOLOGY

Two teaching methods, which rely on essential features of peer instruction, are to be compared using results from a large class of first term Business Administration students at the University of Hamburg. The heterogeneity of the student body – e.g. with respect to prior knowledge, cultural backgrounds and age – poses a particular challenge for the lecturers. How – especially in the well-attended introductory sessions – is one to deliver a sophisticated lecture without losing parts of the audience? The methods described below may offer some help.

Pursuant to **Method A**, the students are instructed to read a text on the foundations of business organisation in preparation for the next lecture. At the beginning of that lecture, so-called 'clickers', electronic voting devices, are distributed among the students, enabling them to respond to a test consisting of single-choice questions.

In a first iteration, the students are to answer a question individually within a time frame of one minute. Their responses are recorded electronically. In the second iteration, the same question is answered again, but this time following a period of one minute during which each student is to convince her or his neighbour of their answer. This method is broadly in accordance with Mazur's peer instruction.

This sequence of two iterations is repeated for each question of the test. Only if the vast majority of students answered the question correctly in the first iteration can the second pass be waived.

In contrast to Method A, according to **Method B** the students are not required to prepare for the lecture with the help of literature. Instead, the lecturer teaches a textbook chapter on Human Resources. Subsequently again a test of single-choice question is conducted in the exact same procedure of two iterations as in Method A.

3. SOME PRELIMINARY RESULTS

Method A was applied to a set of five single-choice questions on business organisation. 90 students participated. Below we list the questions, the answer choices and the results. The correct responses are highlighted.

A1. The functional organisation is characterised by which advantage?

- A) avoidance of suboptimal outcomes
- B) gains from specialisation**
- C) reduced strain on management
- D) direct communication
- E) promotion of holistic solutions

Question A1 – relative frequencies of responses					
Responses	A	B	C	D	E
1. individual responses	9	51	10	19	11
2. responses after discussion	2	64	9	13	12

A2. The divisional organisation is characterised by which advantage?

- A) simple strategic control
- B) low administrative effort
- C) promotion of holistic solutions
- D) greater flexibility and speed**
- E) reduced duplication of effort

Question A2 – relative frequencies of responses					
Responses	A	B	C	D	E
1. individual responses	17	10	11	39	22
2. responses after discussion	14	13	12	44	18

A3. *The divisional organisational form is particularly suited to...*

- A) small and medium-sized enterprises with a relatively small and homogeneous range of goods and services that operate in a relatively stable business environment.
- B) **medium-sized and large multi-product companies that operate in a dynamic business environment.**
- C) large multi-product companies that operate in a relatively stable business environment.

Question A3 – relative frequencies of responses			
Responses	A	B	C
1. individual responses	23	45	32
2. responses after discussion	13	64	24

A4. *The matrix organisation is characterised by which advantage?*

- A) strict delimitation of competences
- B) low administrative effort
- C) easy assignment of success and failure
- D) fast decisions
- E) **systematic incentives for innovation**

Question A4 – relative frequencies of responses					
Responses	A	B	C	D	E
1. individual responses	15	6	18	28	33
2. responses after discussion	15	7	14	16	47

A5. *The line-and-staff organisation is characterised by which weakness?*

- A) The establishment of staffs requires extensive restructuring of the whole business.
- B) **Staffs may influence line managers' decisions according to their preferences.**
- C) There are no clear lines of communication and command.

Question A5 – relative frequencies of responses			
Responses	A	B	C
1. individual responses	21	56	23
2. responses after discussion	20	59	21

The results fundamentally show that the students had some issues answering the questions correctly. Remarkably though, the 'convince your neighbour' discussion in the second iteration served to improve the results throughout. The improvement across the five questions is in the range of 3 to 19 percentage points.

Looking at the range of relative frequencies of correct answers after the first and second iteration, respectively, the following picture emerges:

all five questions on Organisation	relative frequencies of correct answers
1. individual responses	33 % - 56 %
2. responses after discussion	44 % - 64 %

The results so far suggest that the peer instruction method can serve to stir interactive learning processes which in turn facilitate improved test results.

Method B likewise relies on five single-choice questions, which this time concern Human Resources. The level of difficulty is comparable to the questions used in Method A; however here the material is taught immediately prior to the test by the lecturer. 60 students participated in the test. The results are presented below.

B1. Which of the following functions can be attributed to the provision of personnel?

- A) leadership
- B) personnel development**
- C) personnel evaluation
- D) personnel administration
- E) personnel remuneration

Question B1 – relative frequencies of responses					
Responses	A	B	C	D	E
1. individual responses	28	30	12	20	10
2. responses after discussion	19	41	10	24	7

B2. Complementary goals in human resources are ones...

- A) where the achievement of one goal supports the achievement of the other.**
- B) whose chances of success are independent of each other.
- C) where the achievement of one goal interferes with the achievement of the other.

Question B2 – relative frequencies of responses			
Responses	A	B	C
1. individual responses	78	7	15
2. responses after discussion	n.a.		

Due to the good results obtained in the first iteration, the second iteration was waived.

B3. Incentive systems are...

- A) combinations of material incentive instruments that can jointly encourage desired actions and discourage undesired actions.
- B) combinations of incentive instruments that can jointly encourage desired actions and discourage undesired actions.**
- C) combinations of incentive instruments that can jointly encourage desired actions.

Question B3 – relative frequencies of responses			
Responses	A	B	C
1. individual responses	5	72	22
2. responses after discussion	4	82	14

B4. Which of the categories below refers to a classification of incentives according to the object of the incentive?

- A) extrinsic incentives
- B) individual incentives
- C) cotrinsic incentives
- D) internal incentives
- E) **immaterial incentives**

Question B4 – relative frequencies of responses					
Responses	A	B	C	D	E
1. individual responses	40	29	4	8	19
2. responses after discussion	33	14	2	4	47

B5. External recruitment is characterised by which advantage?

- A) vacancies are quickly filled
- B) low recruitment costs
- C) **reduced organisational blindness**
- D) compliance with the company's remuneration system
- E) new positions open up for junior employees

Question B5 – relative frequencies of responses					
Responses	A	B	C	D	E
1. individual responses	2	12	79	0	8
2. responses after discussion	n.a.				

Due to the good results obtained in the first iteration, the second iteration was waived.

For a **comparison** of the two methods, we first note that the students appear to perform better under Method B. Two questions received 78% and 79% correct answers respectively already in the first iteration, rendering a subsequent 'convince your neighbour' discussion superfluous.

A second iteration was, however, called for in the case of questions 1, 3 and 4. Similarly to Method A, we see the results improving in each case. The range of improvement under Method B is 10 to 28 percentage points, compared to 3 to 19 percentage points under Method A.

The range of relative frequencies of correct answers to all five questions under each method is:

all five questions on Organisation/HR	relative frequencies of correct answers
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	Method A	Method B
1. individual responses	33 % - 56 %	19 % - 79 %
2. responses after discussion	44 % - 64 %	41 % - 82 %

In particular the results after the second iteration speak in favour of Method B. The students were clearly informed about the great importance of preparatory reading for Method A, so it is unlikely that a substantial number of them did not read the text. Instead it appears that the first term students encountered difficulties with the reading task of Method A, even though the selected text was well suited for beginners and presumed no prior knowledge of the subject matter. Further research is clearly needed to substantiate these preliminary results.

4. CONCLUSION

We reiterate that peer instruction led to an improvement in the results under both methods, encouraging us to further pursue this central teaching tool. Further, more comprehensive studies should develop additional variants of peer instruction and test their effectiveness.

REFERENCES

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