ETH
Eidgenössische Technische Hochschule Zürich
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Trace Element and Micro Analysis

Experiences with a Classroom Response System: Any more Questions?!

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1. Aims and Motivation

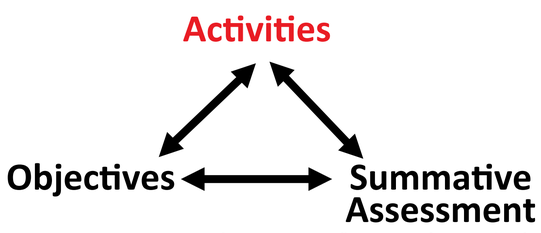

Fig. 1. Constructive alignment for teaching (adapted).

Commonly Mentioned Aims for CRS
- Interaction
- Increase or sustain attention/attendance
- Breaking up the lecture

[No influence on system or mode of use]

Selected Aims for CRS
- Collect opinions and ideas
- Assess prior knowledge
- Check for potential misconceptions
- Assess preparation or recall content
- Assess understanding of concepts
- Emphasis of critical content
- Practice typical exam questions
- Initiate discussions
- Collect questions from students
- Feedback about the lecture
- Lecture or course evaluation (survey)
- Summative assessments (e.g. bonus points)
- Taking attendance
- Classroom experiments

2. Key Challenges[1]

Technical Challenges
- Connectivity
- Capacity
- Display of results

Teacher-related Challenges
- Development of questions
- Time and content management
- Contingent teaching[2]

Student-related Challenges
- Distraction
- Reluctance
- Confusion

3. Developing an Implementation Strategy: *Keep It Simple!*

Guiding Questions to be Answered
Why is the CRS introduced?
Are all students expected to participate?
Are students still expected to ask and answer questions directly?
Do students need any specific software?
How do students login?
Do students have to provide any form of identification?
Is attendance of individuals monitored?
Is the participation used for grading?
How do CRS questions relate to exam questions?
Will the CRS questions and answers be provided as study material?
Is there a specific mode for answering the questions?
Who is to be contacted in case of technical problems?
How are results from polling handled? How is the instruction adjusted?
How to proceed with a lecture if technical problems occur?

Table 1. Selected classroom response systems free of charge or free basic versions.

Name	URL	Price	MCQ*	SCQ*	Number of MCQ options	OEQ*	Setting for time limitation to respond	Export of results	Integration of media	Ongoing instant feedback	Login for students	Anonymous	Distinct handling of numerical
ARSnova Voting	arsnova.eu/ mobile	free	yes	yes	2-8	yes	yes (optional)	csv files	yes	yes	numerical, 8 digits	yes	no
ARSnova Click	arsnova.click	free	yes	yes	2+	yes	yes	no	yes	no	Link, QR code	yes (requires nickname)	no
DirectPoll	directpoll.com	free	yes	yes	2+	no	no	no	no	no	Link, QR code	yes	no
EduApp	eduapp-app1.ethz.ch	for ETH lecturers	yes	yes	2+	yes	(yes)	csv files	yes	no	ETH login	yes, but requires login	no
Kahoot	kahoot.com	free basic features	no	yes	4	no	yes	csv files	yes	no	6 digits for each MCQ	yes, ID optional	no
Socrative	socrative.com	free basic features	yes	no	2+	yes	no	pdf or xlsx files	yes	no	static code, free of choice	yes, ID optional	no
KlickerUZH	app.klicker.uzh.ch	free	yes	yes	2+	yes	no	no	yes	yes	Link, QR-code	yes	yes
Pingo	trypingo.com	free	yes	yes	2+	yes	yes	csv files	no	no	numerical 8 digits, QR code	yes	yes

* MCQ - multiple choice question, SCQ - single choice question, OEQ - open-ended question

4. Examples

From “Analytical Chemistry I and II” part “Element Analysis”, undergraduate course, 180 students enrolled

4.1 Check for Comprehension and Potential Misconceptions

What causes the signal at m/z 54?
(The options were selected from students’ responses to an OEQ.)

A	N+Ar	21%
B	3 times O	9%
C	3 water molecules	71%
D	Cr	0%
E	Fe	0%

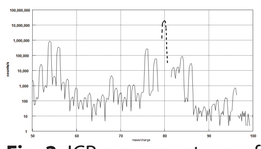

Fig. 2. ICP mass spectrum of an arctic ice sample.

Which criteria have to be met to determine lead in glacial ice (Himalaya)?

True	False	
69%	31%	*Selectivity*
45%	55%	*Mobility*
35%	65%	*Footprint*
19%	81%	*Automation capacity*

When Peer Instruction[3] Works and when it Fails...

What matrix has the analyte cadmium in the prepared solutions after the digestion of chocolate?

		1st vote	2nd vote
A	Cacao, sugar, fat	65%	33%
B	Water	28%	55%
C	cadmium ions	5%	0%
D	No matrix	2%	10%
E	Don’t know	0%	1%

In solution iron may occur in different oxidation states. Is it possible to determine the ratio of Fe^{2+} and Fe^{3+} in water by ICPMS?

		1st vote	2nd vote
A	Yes	56%	56%
B	No	37%	33%
C	Don’t know	6%	11%

4.2 Correct vs. Best Option

Gravimetry is an absolute method because…
- ***A*** *it is a primary method.*
- ***B*** *quantification is based on stoichiometry, amount of substance and mass.*
- ***C*** *quantification is based on a relationship between signal and analyte amount which can be described by physical constants and universal quantities.*
- ***D*** *no calibration is required.*

4.3 Feedback about the Lectures (Exit Tickets[4])

Former scheme (Fall Semester 2017):
- ***A)*** *2-3 lecture-related MCQ (knowledge/comprehension)*
- ***B)*** *What did you especially like about the lecture today? (OEQ)*
- ***C)*** *What is still unclear after today’s lecture? (OEQ)*
- ***D)*** *Do you have additional questions/comments/criticism? (OEQ)*

Revised scheme (starting Spring Semester 2018):
- ***A)*** *1 lecture-related MCQ (knowledge/comprehension)*
- ***B)*** *provide reasoning for answer to A) (OEQ)*
- ***C)*** *What is still unclear after today’s lecture? (MCQ)*
- ***D)*** *Do you have additional questions/comments/criticism? (OEQ)*

5. Key Findings

- CRS are best thought of as **interfaces between lecturers and students** and promote **formative assessment** especially in large classes.
- CRS provides **increased capacity and anonymity** compared to direct questions and answers.
- Select the system and mode of opperation according to intended purposes. **Get familiar with the system of choice.**
- Even after studying existing literature extensively there are still **open issues: development of questions and how to deal with responses**.
- **Development and selection of appropiate questions** remains a major challenge.
- **Only the selection of an option does not indicate understanding or misconception.** Regularily ask for students’ reasoning (OEQ).

This poster is based on a manuscript in preparation for publication by G. Schwarz. Further information can be requested from the author via email.

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References
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