THE INTEGRATION OF GROUP RESPONSE SYSTEMS INTO TEACHING AND LOLA, THE MISSING LINK IN COMPUTER ASSISTED ASSESSMENT

Michael McCabe, Ann Heal and Alison White

The Integration of Group Response Systems into Teaching and LOLA, The Missing Link in Computer Assisted Assessment

Michael McCabe
Ann Heal
Alison White
University of Portsmouth
School of Computer Science & Mathematics
Mercantile House
Hampshire Terrace
Portsmouth
PO1 2EG, UK
Tel. 023 92 843045
Fax. 023 92 843106
Email. michael.mccabe@port.ac.uk

Abstract

Group response (GR) systems, otherwise known as audience or personal response systems, are commonly used on popular quiz shows to “ask the audience”.
The educational value of a portable group response system used at the University of Portsmouth, Teamworker, was demonstrated at the 4th International CAA Conference (Irving et al). At Portsmouth, we are now using a cheaper and more versatile system, Varitronix PRS, during interactive classroom sessions. We identify such GR systems as 3rd generation CAA, because they follow on from 1st generation OMR/OCR and 2nd generation computer based assessment, which have more limited interaction. The greater interactivity afforded by live GR systems complements the greater accessibility of other CAA methods. Hence, while considerable opportunities for the development and effective use of GR systems lie ahead, it will not be at the expense of other CAA. The growth of GR systems as a recognised branch of CAA is expected to continue simultaneously.

Our PICtures of LEarning Technology or PICLETs illustrate diagrammatically the much greater interaction between lecturer, student and computer resulting from effective use of GR systems. While teaching by questioning has been used for over two millennia, since Socrates first used it, its value when linked to effective use of learning technology in the classroom is only just beginning to be recognised. The types of questions presented during live classes are significantly different from conventional objective test questions, in that they are designed to promote interaction rather than examine students.

We have used a variety of different techniques for delivering questions, including the parallel use of on-line computer based assessment. Live and On-Line Assessment (LOLA) is effectively a combination of 2nd and 3rd generation CAA. A group response system, which operates entirely on-line, is suggested as a future possibility

There is considerable scope for wider and more structured use of GR systems in formative assessment. In our experience it has been during revision classes preceding summative tests that our students have gained the greatest benefits from the PRS system.

Keywords

Interactive classrooms, group/audience/personal response systems, Socratic method, teaching by questioning, live assessment, on-line assessment

Historical Perspective

Despite his lack of writings, the ideas of Socrates (470-399 BC) can influence our present day use of learning technology in higher education. The Socratic method of teaching by question and answer (Gower and Stokes, 1992; Paul, 1993) has relevance for interactive classrooms, where the latest technology is used for live computer assisted assessment. Key elements of the method are:

- initial concealment of the truth of the matter under discussion, using questioning rather than telling to involve learners
- the use of a conversational dialogue to elicit truths
- seeking concepts based upon correct definitions
- testing of definitions inductively with recourse to common experience
- testing of definitions deductively by drawing out implications

Questions may seek clarification, viewpoints or perspectives and probe assumptions, reasons, evidence, implications. The overall approach is comparable to the modern scientific method. Nowadays the questioning of students can help a teacher to:

- evaluate the level of understanding
- provide and receive feedback
- modify the level of teaching
- deal with misconceptions early on
- improve teaching material

The introduction of Optical Mark Reader (OMR) and Optical Character Reader (OCR) technology in the early 1970s initiated the computer assisted assessment (CAA) revolution. This first generation of tools allowed the automation of marking, but supported a linear, non-interactive process. For example, a lecturer sets a test for students; completed forms are fed into a computer; results are returned to the lecturer, who returns results to students

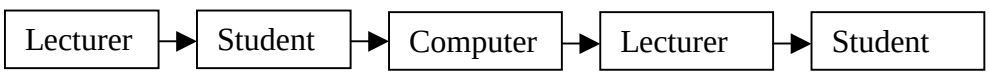

Fig 1 Schematic View of OMR/OCR (1st generation CAA)

While OMR/OCR technology still has its place, e.g. for computer marked assignments in the UK Open University, computer *based* assessment in which a student answers questions on a computer and receives immediate feedback, has become the more common form of CAA in universities. The student-computer interaction adds a second dimension to the assessment process as illustrated in Figure 2.

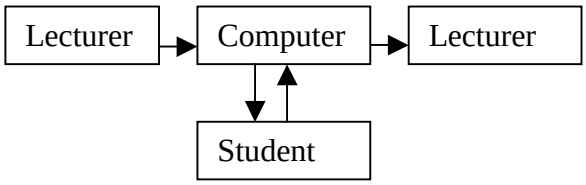

Fig 2 Schematic View of Computer Based Assessment (2nd generation CAA)

This second generation of CAA has moved from standalone computers to local networks to on-line delivery, but the primary interaction is between student and computer. The lecturer prepares questions for computer delivery and examines the results afterwards, but does not normally interact directly with the student. We have used this type of computer based assessment successfully in support of teaching for 10 years for diagnostic, follow-up, practice self-assessment and exam tests, available either on local networks or on-line. We expect that this type of CAA will continue to develop and expand, especially as on-line systems become more powerful and reliable. Yet unless computer based assessment is used intelligently, in conjunction with other forms of teaching, it can easily become impersonal. The lecturer can become a technical author preparing banks of questions and feedback for an increasingly remote group of students. The next generation of CAA is opening up new possibilities for better teaching and learning.

Use of Group Response Systems

Group response GR systems can be regarded as the third generation of CAA (Table 1), because of the extra dimension of interaction, which they allow.

Generation	Type	Year	Interactivity	Input
1st	OMR/OCR	1975	Low	Paper or card
2nd	Computer Based	1985	Medium	PC mouse or keys
3rd	Group Response	1995	High	Handset

Table 1 Generations of Computer Assisted Assessment

They are used trivially during popular TV game shows, but can be exploited with far greater purpose in higher education. Teamworker was the first GR system to be used at Portsmouth (Irving et al,2000), but this has been superseded more recently by the Varitronix Personal Response System or PRS (http://www.varitronix.com). Students enter their answers individually via a personal handset during face-to-face classes: lectures, tutorials or workshops. The currently adopted PRS system, allows the input of a choice from 0 to 9 and a high, medium or low confidence level. More sophisticated systems are available, but are not so portable and need to be hard-wired into an interactive lecture theatre. Receivers in the classroom pick up privately entered student responses and feed them into a local PC. Answers may be

collected anonymously or be identifiable against individuals. A summary of results, including the level of confidence can then be displayed graphically for immediate feedback, analysis and discussion.

Models

Figure 3 illustrates why the scope for interaction is greater when a GR system is used

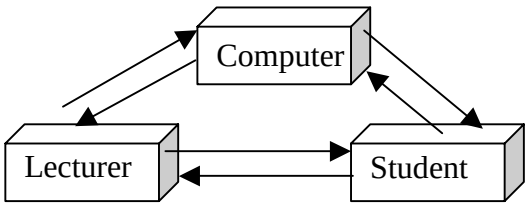

Fig 3 Schematic View of Live Group Assesssment (3rd generation CAA)

Students interact with the GR system by entering answers and seeing the results. The lecturer interacts with the computer by controlling the mode of question and results delivery, and sees the results at the same time as the students. The lecturer interacts with the students by posing the questions, giving advice and feedback based on the results. The students become more motivated to interact with the lecturer by asking further questions themselves and commenting on the results. Although the use of Socratic questioning has drawbacks (Russell, 1991), but some are eliminated by use of GR systems, e.g.

- active involvement of large numbers, not just one or two individuals
- live computer feedback, allowing immediate analysis of the results
- anonymous responses, reducing peer pressure and fear of embarrassment
- input of confidence levels, providing more subjective data
- precisely controlled time limits for input, to encourage faster responses

Benefits for students include immediate checking of their understanding, comparison of correctness and time taken with their peers and a feeling of participation. Benefits for the lecturer include an immediate measure of class understanding, allowing the content and pace of the class to be adjusted, and more responsive students.
The enjoyment factor is also important for both lecturer and students.

Our description of GR systems as 3rd generation CAA does not mean that they replace existing CAA, but rather that they provide a missing link in the chain of computer assisted assessment. For example, some of our course units begin with computer based diagnostic tests. These may be followed up with further opportunities for computer based self-assessment and remedial study. Typically there follows a period of classroom sessions, where the emphasis is on teaching and learning rather than assessment. When learning has progressed sufficiently, practice CAA tests become available in preparation for graded exams. We view GR systems as filling a gap in CAA provision as shown in Figure 4.

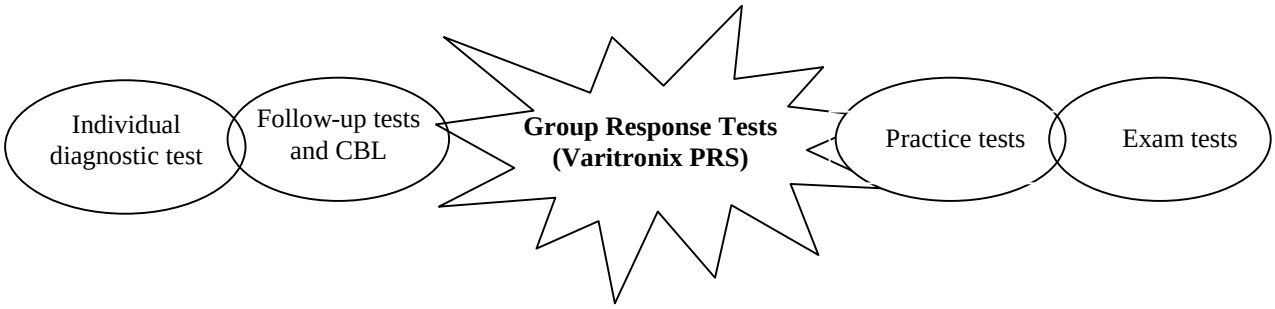

Fig 4 The Missing Link in Computer Assisted Assessment

Assessment becomes an integral part of teaching and learning, when both lecturer and students receive immediate, live feedback and face-to-face teaching can become more responsive to student needs. The interactions arising during different teaching situations can be presented diagrammatically as PICtures of Teaching Assessment and Learning or "PICTALs".

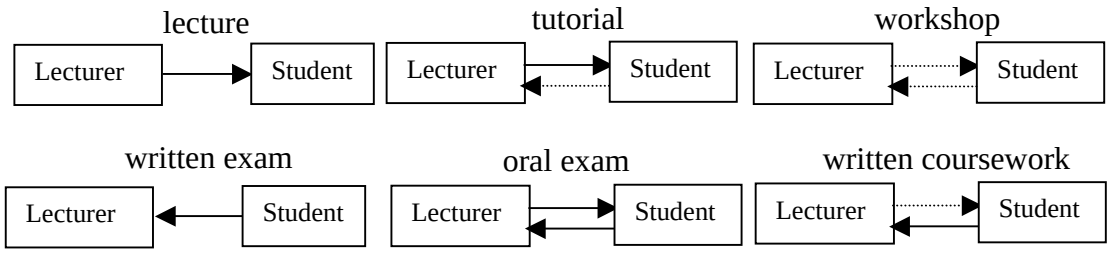

Fig 6 PICTALs for Traditional Teaching and Assessment

It is no accident that our acronym places assessment in its rightful place as central to teaching and learning, rather than tagged on at the end. PICTALs become more complicated when learning technology is introduced, e.g. computer based or on-line learning in a Virtual or Managed Learning Environment. "PICLETs" or PICtures of LEarning Technology are an extension of PICTALs to include computer interaction, e.g. see Figures 1 to 3.

We have used computers during classes for simultaneously running a group response system and for delivering other kinds of interactive software, including computer based assessment. We therefore find it appropriate to distinguish the use of GR systems from other applications. A PICLET, which summarises the interactions, is shown in Figure 7.

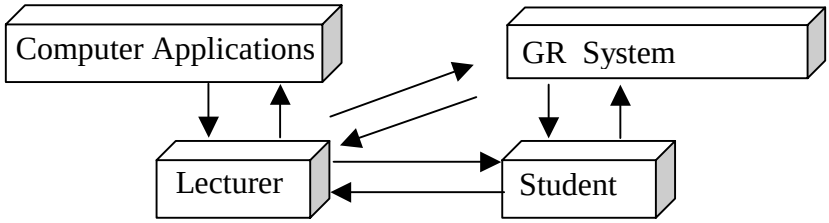

Fig 7 PICLET for Group Response with Software Support

Techniques

We have used the PRS system in teaching situations ranging from revision classes to small group tutorials and peer assessment sessions. Questions have been delivered in several different ways: verbally, as plain text delivered within the PRS system, by separate OHP transparencies, by independent Powerpoint presentations and via interactive computer based assessments with feedback.

It is often convenient to use other computer applications to deliver questions, and in several trials the group response system has been used in conjunction with on-line computer based assessment. PRS and Question Mark Perception (McCabe, 1998a,b and http://www.qmark.com/) have been used together allowing questions and feedback presented during a revision class to be repeated by students later; in order to reinforce their learning. This Live and On-Line Assessment (LOLA) shown in Figure 8 exploits the benefits of both 2nd and 3rd generation CAA.

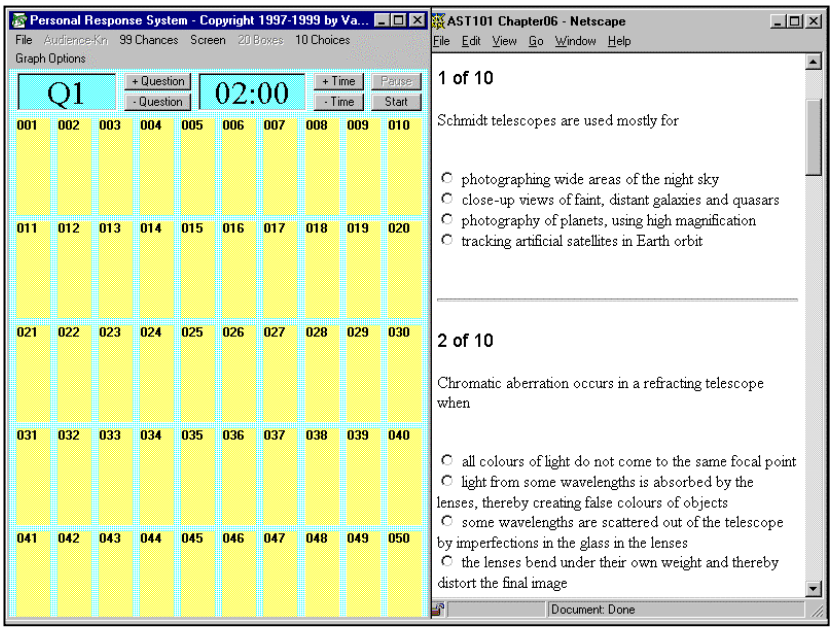

Fig 8 Live and On-Line Assessment using PRS and Question Mark Perception

Group Response Questioning

Group response questions are often different from standard objective test questions, in that they are designed to encourage interaction. For this reason we identify some question types which would not normally be used in computer based assessment:

Question type	Example	Uses
tryout or trial	2 + 2 = ?	check system, identify misuse
polling	Which is hardest?	identify student problems first
ambiguous	How far is London?	encourage student response
provocative	Which falsehood is true?	encourage student response
indiscriminate	How many are correct?	seek preliminary feedback
ill-defined	Solve x + y = 2	encourage student response
step-wise	Stages of algorithm	help answer longer questions
branching	Which part shall we do?	flexible delivery of material
evaluation	How interesting was …?	seek student feedback

Extensive course delivery by questioning in the manner of Socrates would be prohibitively time-consuming and often inappropriate. Nevertheless there remains considerable scope for wider and more structured use of GR systems in formative assessment. In our experience it has been during revision classes preceding summative tests that our students have gained the greatest benefits from the system.

Future On-line Development

We have tried out the use of PRS in a range of teaching situations, in large lectures and small group tutorials, for peer assessment. The main benefit is the greater interaction between lecturer, students and computer. The main drawback is the need for specialist equipment, which has to be either set up before each class or installed permanently in an interactive lecture theatre. Accessibility is therefore limited both by location and the times of classes.

One possible alternative to an interactive classroom is a virtual group response system in which sessions are conducted entirely on-line. Questions could be displayed to group members simultaneously in different locations; their responses could be logged and results presented on-line for general discussion, e.g. via a chat-room. For the present, the value of group response systems lies in face-to-face teaching.

References

B.S.Gower and M.C.Stokes (1992), Socratic Questions: The Philosophy of Socrates and its Significance. London/New York: Routledge, ISBN 0-415-06931-9.

Irving, A., Read, M. et al., (2000) Use of IT in Exam Revision, Proceedings of the 4th International Conference on Computer Assisted Assessment, 105 – 110, Loughborough University, ISBN 0-9533210 8 8

McCabe, *E.M.,* (1998a) CAA Workers Do IT with Perception, Proceedings of the 2nd Annual Conference on Computer Assisted Assessment, 105 – 110, Loughborough University, ISBN 0-9533210 1 0

McCabe, *E.M.,* (1998b) Strategies for the Computer Assisted Assessment of Mathematics, Proceedings of the 1st International Conference on the Teaching of Mathematics, 212 – 214, Samos, Greece, Wiley

R.W.Paul, (1995) Critical Thinking: How to Prepare Students for a Rapidly Changing World, Publisher: Foundation for Critical Thinking, ISBN: 0-944583-09-1

Russell,B. (1991) A History of Western Philosophy, 2nd Edition, London:Routledge