

## PERCEPTIONS OF UNIVERSITY STUDENTS REGARDING COMPUTER ASSISTED ASSESSMENT

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### ABSTRACT

Computer assisted assessment (CAA) is a common technique of assessment in higher educational institutions in Western countries, but a relatively new concept for students and teachers in Pakistan. It was therefore interesting to investigate students' perceptions about CAA practices from different universities of Pakistan. Information was collected through a questionnaire, completed by 1877 students. It was concluded that overall sampled students were aware of CAA. Comparatively, female students were found to be more highly inclined towards CAA. Sampled students from different departments (i.e., Commerce, Mathematics and Pharmacy) and from universities D and E showed a particularly positive attitude towards CAA. However, overall sampled students felt that CAA overburdened them, and created some administrative and managerial problems, so teachers should probably avoid using this technique of assessment as routine. Prominent advantages regarding CAA referred to by the students included time saving, being more interesting, and being unbiased. Disadvantages included hardware and software related problems during examination.

### INTRODUCTION

Learning is central to education (Desforges & Fox, 2002). The concept of learning may be thought as a 'consumer' oriented term, while 'education' involves producers as well as consumers. Once learning is separated from education, it becomes incidental and could be only for fun (Jarvis, 2002). Assessment is an important factor that reflects and affects the quality of learning and education. Assessment plays a major role in driving student learning (Muwanga-Zake, 2006; Warburton, 2006; McLaren, 2008). According to the National Research Council (2003), 'assessment is high quality information about students' performance that informs teaching and learning'. Assessment identifies learner needs and can influence future planning if linked with appropriate resources. Moreover, assessment is a well organized and well defined measuring tool providing timely feedback for learning outcomes. Debus, Lawley, and Shible (2008) highlighted the importance of feedback in assessment by characterizing it as informative, specific, personalized, timely, consistent, detailed and legible.

Information and Communication Technologies (ICTs) offer many new possibilities for successful assessment. As ICTs were integrated in learning and assessment, educators demanded more effective, flexible, interactive, customized and just-in-time online instructional and assessment systems. Research exploring the role of ICTs in the teaching, learning and assessment process conclude that online learning and online assessment are impacting pedagogical developments in higher education (Hricko, Howell, 2005). Bach, Hynes and Smith (2007) and Warburton (2006) emphasized the importance of ICTs and explained that 'universities have maintained the level of education for hundreds of years without the use of computer-based technologies, but the dominance of ICTs in the past two decades adds value to this process rather than frustrating it or even preventing it'. Due to the dominant impact of technology, the assessment process is gradually shifting from the traditional pen and paper method to computer based or e-assessment (Dube, Zhao, and Ma, 2009). E-assessment, online assessment, computer assisted or aided assessment; computerized assessment or computer based assessment is any assessment activity which involves the use of computers (Bull, 1999; Chalmers, McAusland, 2002; TAFE Frontier, 2002, Elliot, 2003).

Pakistan is a country of 160 million people with only a 53% adult literacy rate. It relies on conventional means of imparting education within the limited resources of the educational budget, which is merely 2.1% of the GDP (Siddiqui, 2008); certainly not enough compared to international standards. Even with these limited resources, the Higher Education Commission (HEC) of Pakistan has been focusing on equipping higher education faculty with the latest ICT tools and techniques to increase the effectiveness of teaching and learning (HEC, 2010). It was personally observed by the researchers that all teachers from all departments of all public sector universities of Pakistan were assessing their students' progress through paper and pencil based examination systems, except those departments who were offering 'Computer Studies' as a compulsory subject in their curriculum. Regarding this compulsory subject, the computer was partially being used by teachers and students during assessment. CAA

is thus a relatively new term in the context of universities in Pakistan. Some teachers were using computer technologies in the process of assessment on the basis of their own interests and/or expertise, but computer technologies (i.e., construction, administration, marking and reporting directly on and via computer) were not fully implanted in any of the public sector universities of Pakistan. Therefore, it was important to know students' perceptions about online examinations, whether they had experienced CAA before or not.

### LITERATURE REVIEW

The pressure for frequent assessment for the measurement of stated learning outcomes especially in those classes where large numbers of students are registered has resulted in the development of CAA. Bull (1999) focused on the impact of CAA on HEIs and proposed strategies for planning and implementation. She proposed that greater collaboration between supporting staff and academics could effectively reduce the implementation problems of online assessment. Bull concluded that CAA had the potential to impact institutions. Specifically, different format and types of assessment were available in CAA, and faster quality and speed of feedback could enhance the capability of academics to pinpoint student progress and learning deficiencies. Bull explained that if CAA is employed correctly, it has the power to ensure that curriculum modifications ensue and lead the institutions to revise existing assessment methods. The perceived validity of CAA and the risks associated with using technology were the major disadvantages highlighted by Bull.

Chalmers and McAusland (2002) explained CAA in the context of pedagogical applications, noting that it enabled teachers to test their students covering a wide range of content, reduced teacher workload especially in the case of double marking, saved time and resources, and helped identify students' learning problems by adapting to match their abilities. Administratively, CAA saves time in supervision, invigilation, marking and double marking, generating reports and communication with students. On the other hand, limitations of CAA were in terms of both pedagogical and administrative issues:

- To construct objective questions needs adequate staff training, which is a time consuming process,
- Frequent use of multiple-choice items can lead to a focus on testing a superficial level of understanding,
- Additional training of IT staff is required for CAA invigilation,
- To attempt an online examination, students should have a basic understanding of IT competencies,
- An issue may rise regarding CAA for students with special needs,
- Security measures are required for: student identification, preventing unauthorized access to question and answer files, cheating and plagiarism,
- A high level of coordination is required among teaching staff, IT staff and administration.

Moreover, Chalmers and McAusland conducted a case study on second year students of Economics which was aimed to understand the impact of CAA on their learning. They found that students' understanding had improved. Their mean CAA score was higher than that from traditional essay-based examination. Students were encouraged by CAA to do some harder deep learning, which in the long run would be more valuable.

TAFE Frontier (2002) designed an online survey to capture a snapshot of online assessment practices in vocational education and training, with a view to using the data to inform a guide to online assessment. A total of 132 survey questionnaires were distributed, from which there were 43 responses via online, face to face or telephone interviews. Respondents defined online assessment as: An efficient and flexible means of conducting assessment and giving feedback; Using online technologies to support, wholly or in part, summative and formative assessment; Active participation by learners in an assessment event independently or as part of a group to achieve course outcomes; assessment where the assessor has not met the assessee; where participants have the opportunity to submit assessments through online channels, providing a more flexible approach to submitting work; demonstration of competency through the completion and submission of assessment tasks through the internet; a confused term and in most instances related to behaviorist views of student learning; Computer marked short quizzes to assess knowledge and online facilitator-marked assessments; to be able to determine the learner's ability to understand the material using the internet; and assessment that involves some kind of electronic component, for example sending out, doing, submitting and collecting information from online resources. Online submission of assignments/essays; Multiple Choice Questions (MCQs), True/False and short answer based quizzes; email, web page design, problem solving, portfolios, journals and spreadsheets were reported as tools of online assessment. In a question about 'suitability of online assessment to a range of study areas', respondents argued that online assessment suited assessment of information retention and underpinning knowledge, rather than practical skills. One of them responded that video conferencing provide opportunities for properly supervised online assessment of practical skills.

Sim, Holifield and Brown (2004) discussed issues related to the implementation of CAA, interoperability of questions, security, test construction and testing higher cognitive skills. Sim et al. explained that there are certain limitations in the different assessment methods of universities because of students' different exposure to IT. They identified 50 various assessment techniques, with examinations and essays the most common among them. They defined CAA by quoting Bull and McKenna, who gave CAA as the most common term for the use of the computer in the assessment of students. They concluded that the most important lesson is that an institutional strategy greatly influences the success of the implementation of a CAA system. Therefore, it was recommended to policy makers to formulate an effective strategy regarding CAA (e.g., security procedures, authentication and invigilation in remote locations). The second important lesson was concerned with staff development and training in test construction within a CAA environment.

In the same direction, Conole and Warburton (2005) comprehensively reviewed the design, delivery and analysis of CAA. They explained that 'computer-based assessment can be subdivided into stand-alone applications that only require a single computer, applications that work on private networks, and those that are designed to be delivered across networks such as the web'. They perceived CAA as high risk but central to the teaching and learning process. They also concluded that the role of technology and its expected impact on assessment was still in its infancy. It was required to develop new models for exploring this, and understanding more about the barriers and enablers in using these tools effectively.

Muwanga-Zake (2006) evaluated the diagnostic value of CAA in the process of teaching and learning. They concluded that learners realized the usefulness of CAA and criterion-referencing as impacting successive learning performance. Results showed that learners improved due to self-assessment and descriptive feedback which enabled them to diagnose and remedy mistakes themselves, through dialogue with or without assistance from the teachers. The free test atmosphere, instantaneous marking, and the diagnostic nature of test items supported self-diagnosis and led learners to request more testing, which ultimately increased competitiveness and excitement, especially when learners were aware of improvement. In case of teachers, they reflected that CAA could show learners' problems and styles of thinking and also can test large number of students in short time. Moreover, CAA data could provide insight on teaching styles and problems.

According to JISC (2008) 'e-assessment is emerging as a major driver for e-learning for both students and staff'. They explained that on-demand testing facilitating the students having more control over their learning and moving toward more personalized learning. JISC added that in regard to questions about e-assessment, people have the following three assumptions:

1. The assessment will be objective only,
2. The assessment will be limited to multiple choice items only,
3. The assessment can only test recall or low level learning outcomes.

While pointing out the falsity of the above assumptions one-by-one, JISC explained that e-assessments has always involved subjective judgment and also reduces judgment bias. ICT has been incorporated into assessment in further and higher education in a number of ways, for example, the analysis of student postings to discussion boards in computer mediated conferencing and automated essay marking. In rejecting assumption 3, they noted that carefully constructed MCQs can assess higher order skills, and it was also possible to create questions, which might be easy to a student who has comprehended the topic whereas one who has not would struggle. JISC has also raised further issues associated with e-assessment:

1. Time required: E-assessment saves time in displaying results including error checks and results analysis. But when the question is to assess the skills, the time and expertise required cannot be underestimated.
2. Misleading clues: frequent quizzes from a particular area of content can mislead the students to guess what is and isn't important.
3. Equity and diversity: these are major issues when computers are involved in assessment process for different student groups relating to language, gender, computer anxiety and exam equivalence.
4. Equivalence: the issues of equivalence between different forms of assessment (i.e., paper-pencil based compared to e-assessment) can affect student performance. Innovations in CAA introduced a new range of variants on this theme.
5. Effects of using a full range of marks: assessment in mathematics and other science subjects which use a full range of marks may lend themselves to CAA.
6. Greater Scrutiny: CAA has produced quality and efficiency gains in assessment, but even then there have sometimes been lower pass rates as compared to essay type assessment.

7. Design of questions: to construct an MCQ-based test for e-assessment requires a higher order of skills and expertise in teachers.
8. Disparity: the use of CAA has a positive impact on the test scores of high attaining pupils, when compared to those from paper-based tests, because higher-attaining students more quickly adapt to new assessment approaches. Lower-performing individuals will be disadvantaged when CAA is used, because a greater workload and additional effort is required to complete a computer-based test.
9. Change in working practices: the time saving advantage of CAA has changed the working practices for academics in terms of acquiring training for designing and construction of e-assessments. Students are also required to train for undertaking CAA, which raise the issue of who should be involved in that training and when it should take place, especially in the context of overloaded curricula.
10. Plagiarism: CAA discourages plagiarism. A high level of imagination and rigor is required for the design of assessment online, compared to that for more traditional forms of assessment.
11. Off-campus assessment: CAA enables the presentation of questions to students in different orders, with distracters in different orders, and if sufficient questions have been compiled of sufficient integrity, then they can be used for different tests. All of this allows for students to sit in adjoining desks in computer laboratories that will at other times be used for learning activities. This is fairly straightforward for on-campus students, but could be more problematic for students taking courses at a distance. However, Rovai (2000) suggests that this difficulty can be overcome by using 'proctored testing', where academics arrange for students to sit online assessments under test conditions in alternative venues.

Debus, Lawley and Shibl (2008) evaluated educators' perceptions of automated assessment in terms of workload and quality of feedback. They used an automated feedback generator across multiple tutors on assessment items within an MBA course. They concluded that while the workload impact was generally positive with saving in both cost and time, improvements and modifications to the system could further reduce workloads. Specifically, improvements related to initial installation and training would significantly reduce the time required to be able to start using the system. The results indicated that AFG improved timeliness, consistency between markers, and recycling of useful comments.

Similarly, other studies related to CAA were based on strategies for planning and implementation, models for designing CAA, and the role of CAA in formative, summative and diagnostic assessment. But very few studies were found on the topic of perceptions about CAA of students. One example was Shearer, Gouldsborough and Grady (2006), who analyzed the perceptions of staff and students by comparing CAA with traditional methods of assessment in practical Physiology classes. In an experiment, they utilized computer-based short-answer assessments for nearly 300 students and compared it to paper-based assessment of the same students. They concluded that students were generally well-disposed toward CAA (75% of the students responded that they had no preference in assessment methods in the future). Remote access to questions and ease of submission were positive aspects, but lack of internet access was a perceived disadvantage. On the other hand, the most common advantages cited by staff were reduction in marking time and paperwork, the improved quality of feedback to students, as well as the potential for the software to detect plagiarism and administer anonymous marking. The need to tailor questions to the technology and having to adapt answers for marking onscreen were the main disadvantages found by staff. The main difference between the Shearer et al/Debus et al research studies and the present study is that CAA is not really applied in Pakistan. The above mentioned researches were conducted in situations where CAA was applied. Therefore this study is significant to all of those teachers, students and administrators who are interested in CAA in Pakistan.

## THE STUDY

*Sampling:* In 2008 there were 111 (60 Public Sector and 53 Private Sector) universities in Pakistan (Higher Education Commission, 2008), out of which 36 (20 Public Sector and 16 Private Sector) universities from Punjab Province were delimited for this study. It was felt that this province would give a representative sample compared to other provinces, and it was convenient as the place in which the main researcher was located. Out of 20 Public Sector Universities, 8 (40%) were randomly selected for inclusion in the sample. Private Sector Universities were dropped because of their limited number of students and the great variety of different disciplines they offered. All male and female students from all teaching departments of different disciplines of sampled universities constituted the population of this study. After the selection of the universities, different teaching departments of Pure Sciences, Social Sciences and Languages were randomly selected to be included in the study. However, students of each department could only be chosen if 'available' in their classes. Permission was sought from all of the head of the departments in each university before data collection. In the response of this request, 63% of them allowed to collect data from their students, while the remaining head of the departments were sent another request after 2.5 months to allow the researcher for data collection. At this time only 15% responded and rests were requested again and again after one month and then 15 days respectively. In

all 2200 students were asked to complete the questionnaire. Of these, 1877 (85%) questionnaires were collected successfully after completion.

*Questionnaire:* The questionnaire was based on questions developed for this study. Each question encouraged a response on a 5-point Likert Scale. All items of the questionnaire were couched in relation to issues emerging in the literature review. The methodology and format of the questionnaire followed the studies of Barbra and Sylvia (1999) and Yavuz (2005). It also stemmed from literature such as Debuse, Lawley and Shibl (2008), Irving, Read, Hunt, and Knight (2000) and O'Hare (2001), who used a 5-point Likert scale model to measure student attitude towards CAA in different experimental studies conducted in different disciplines.

The questionnaire was comprised of two major parts. Part 1 comprised of 12 items was generally for all students, while Part 2 consisted of 17 items and was for students who had some experience of online assessment. Part 2 was extended by adding two open ended questions regarding advantages and limitations of CAA. In Part 1, generally simple items were included, but in Part 2 items were included which were directly related to their online assessment experience.

To explore the issue of validity, the questionnaire was used in two pilot studies. In pilot study 1, the questionnaire was administered to students in three departments (Education, Mathematics and English) of two different universities (A and D). Sixty students including five males and five females in each of six departments completed the questionnaire. During administration of the questionnaire, any difficulties in understanding the terms, required space for answering the items and other questions raised by the students were recorded and then thoroughly discussed with a panel of experts. It was then decided to change the format by replacing some items, and include new items to make the questionnaire more self-explanatory. Due to the changes incorporated, it was then necessary to conduct a further pilot study. Departments of Business & Administrations were included in pilot study 2. Again, sixty students were chosen with equal distribution across departments and of gender. Minor revision was made as a result of the second pilot study. The final draft of the questionnaire was sent to the six different experts in the field of Education and Assessment for their opinion on. These six experts were Head/Director of departments in different universities of Punjab and were knowledgeable in the field of Assessment, Examinations and Computer Assisted Assessment.

*Response Rate and Analysis:* The questionnaire was administered to 2200 students, of which 1877 (85%) responded successfully. Of these 1877 students, 1055 (56%) were female and 822 (44%) were male. Percentages and Pearson Chi Square ( $\chi^2$ ) tests at  $\alpha = 0.05$  were applied to draw conclusions from the collected data. All positive statements in Parts 1 and 2 were weighted from +2 to -2 (Hirsch, Frank, Shapiro, Hazell and Frank, 2004; Desselle, 2005) to analyze students' response and negative statements in vice versa. Where +2 and +1 rated 'Strongly Agreed' and 'Agreed' respectively while -1 and -2 were used for 'Disagreed' and 'Strongly Disagreed' respectively for all positive statements. And '0' was meant by 'Unable to Decide'. All responses to the open ended questions were analyzed in terms of themes emerging, and the frequency of the most commonly emerging themes was indicated in the form of percentages.

## FINDINGS

It was found that 1052 (52% female, 62% male) students out of 1877 (56% female, 44% male) sampled students had had experiences of computer-based assessment. The examples they gave of these experiences were Army Medical College Entry Tests (2%); PAF (Pakistan Air Force) entry test (8%); online test or papers conducted by their teachers in universities (20%); computer practical in all computer-based subjects (60%); online NTS (National Testing Service), GAT (Graduate Assessment Test) online, GRE (Graduate Record Examinations) online examination (7%), Microsoft Online Certification Examinations (2%) and online TOEFL (Test Of English as a Foreign Language) online (1%). The data of both parts were interpreted in terms of whether student responses were an overwhelming majority (81% and above), a good majority (71% to 80%), or a simple majority (61% to 70%).

*Results from Part 1:* Part 1 of the questionnaire was completed by all sampled students i.e., 1877. An overwhelming majority (i.e., more than 80%) of the sampled students reflected a positive attitude towards computer-based system of examinations in statements 2, 7, 11 and 12 (i.e., 'students' should be trained for computer-based system of examinations', 'CAA may help to improve and maintain standards of our examination system', 'CAA is requirement of the time' and 'CAA should be implanted in all universities' respectively). A good majority (70%-80%) of the sampled students agreed that 'CAA is an interesting technique of assessment', 'interactive exercises may help to improve marks', and 'students should be given an opportunity to submit their assignment online' (i.e., statements 1, 3, and 8 respectively). However, a simple majority of the sampled students agreed that 'the computer does not need to be used in tests or exams' (i.e., statement 4).

The positive attitude of sampled students was counted per statement. It was found that all sampled students from universities A and E responded positively to eight different statements. Moreover, all sampled students from Biology, Commerce, Education and Mathematics departments responded positively to seven different statements. The positive attitude of sampled male students was counted per statement. It was found that sampled male students from university E responded positively in seven different statements. Eight positive statements were counted in departments of Chemistry. The positive attitude of sampled female students was counted per statement. Sampled female students from universities A, E and H responded positively to eight different statements. Moreover, female students from departments of Commerce responded positively to eight different statements.

Calculated values of  $\chi^2$  showed significantly varying attitude differences between male and female students in statements 1, 2, 5, 6, 9, and 10 (Table 1). From the percentages, 79% male students in statement 1 were more interested in CAA than female (78%), while female students in statement 2 (85%), 5 (78%), and 9 (81%) were more positive towards CAA than to male (81%, 73%, 79% respectively) students. In statements 4 and 7 both male and female students were not clear about their decisions because of the minimum difference in the percentages of their responses. Calculated values of  $\chi^2$  showed significantly varying attitude differences between sampled students from different universities in all statements except statement 7 (Table 1). Comparatively, 90% students from University E were more positive towards CAA. Calculated values of  $\chi^2$  showed significantly varying attitude differences between the students from different departments in all statements (Table 1). It was observed that 97% of students from departments of mathematics agreed or strongly agreed that CAA saved time.

*Results from Part 2:* It was found that 56% (1052) sampled students were having experience of online examinations. An overwhelming majority of the students reflected their positive attitude towards CAA, as 'CAA is an interesting technique of assessment', they believe that it 'could support students to maintain their standard in examinations'; 'immediate feedback saves students' time', 'it is reliable because results are always unbiased in online system of examination'; and 'cheating is almost impossible in online system of examination therefore it is much more secure technique of assessment' (statements 1, 8, 10, 13). The same patterns of results were observed with respect to the students of all universities and of all departments.

A good majority of the students declared their positive attitude towards CAA: 'interactive exercises help to improve marks' and 'CAA is helpful in self assessment' (statements 7 & 9). The same patterns of results were found by the students of all universities and all departments except Economics. However, a good majority of the students argued that 'online system of examination overburdens the students to prepare for exams, so teachers should avoid it' and that 'uncertain and unexpected failure of technology during online examinations damages students' (statement 15 and 16). The same patterns of results were found in sampled students from all universities except G and all departments except Biology and Mathematics.

It was found that students of universities D and H and from departments of Pharmacy responded positively to six different statements out of 16 given in Part 2 of students' questionnaire. Male students of universities C, D and H responded positively in five different statements and Business & Administration and Chemistry departments in seven out of 16 statements given in Part 2 of the questionnaire. It was found that female students of D and H universities responded positively and Biology, Commerce, CS & IT (Computer Science and Information Technology) and Pharmacy in seven different statements out of 16 statements.

Calculated values of  $\chi^2$  showed significantly varying attitude differences between all male and female students in statements 2, 7, 9, 11 and 16 (Table 2). It was found from the percentages that female students showed a comparatively more positive attitude towards CAA in all of these statements (i.e., 86%, 78%, 52%, 81% and 92%) than male (i.e., 81%, 73%, 48%, 79%, and 90% respectively). Significantly varying attitude differences were found between the students from different universities in all statements except statements 8, 9, and 11 (Table 2). It was found that 92% students from University D showed a more positive attitude towards CAA (statement 9). Significantly varying attitude differences were found between the students from different departments in all statements (Table 2). It was found that 100% students from departments of Psychology and Pharmacy showed a more positive attitude towards CAA (statements 13 and 14 respectively).

The values of percentages regarding advantages and disadvantages, expressed by the experienced students were: CAA could save their time (n=277, 16%); female students were happy to find immediate feedback (n=79, 6%); male students agreed that online assessment is an interesting technique (n=57, 7%); unbiased judgments were available (n=56, 7%); and self-assessment could improve their GPA (n=56, 7%). On the other hand, female and male students estimated that it could be difficult to implement online examination systems (n=177, 11%) in

universities. Female students faced some hardware and software problems (n=62, 7%) during their examinations and expressed that they saw their fellows in trouble because they were not experienced in online examination systems or not trained for using the internet (n=62, 7%). Male students also faced some troubles related to hardware and software problems during their exams (n=68, 9%).

## CONCLUSIONS

The research presented in this study investigated students' perceptions of the contemporary utilization of CAA or online examinations in public sector universities of Punjab, Pakistan. IT experts and educationists in Pakistan are working hard to implement and improve computer assisted instruction (CAI) systems, but CAA or online examination methods are still ignored by them. This research has contributed by highlighting the importance of CAA to administrators, educationists and IT experts, who need to plan and implement computer technology in this phase of education. This research has also increased awareness about CAA among students and helped the researcher to plan and implement online examination systems in the near future.

It was interesting to find that students were knowledgeable about online examinations, due to online admission tests of medical colleges; online NTS, GAT, GRE, MS Certification, TOEFL tests and computer-based classroom tests. They felt that online examination was not an exceptional technique of examinations for them. It was observed by the researcher during the survey that in all public sector universities a subject based on computer studies was compulsory for all students of all departments. Teachers assessed their students' skills of computer applications, in that particular subject, online.

From the results of Part 1 (completed by all students either having previously online examination experiences or not) it was clear that overall students had a positive attitude towards CAA. However, students from universities A and E and departments of Biology, Commerce, Education and Mathematics were comparatively more inclined towards CAA. Statistically significant attitude differences between the students of universities and different departments also reflected that the students from university E and departments of Mathematics were more interested in CAA.

Male students from University E and departments of Chemistry were more positive towards CAA than to other males from other universities and departments. Similarly, female students from universities A, E and H and from departments of Commerce were found to be more interested in online systems of examinations than other females of other universities and departments. By comparing the values obtained from the above findings it was found that overall female students were more interesting in online systems of examinations than male students. It was confirmed from the results of  $\chi^2$  test showing statistically significant differences between the attitude of male and female students.

From the results of Part 2 (i.e., completed by only those students who had previous experiences of online examination), students were highly interested in CAA. Students from universities D and H and departments of Pharmacy were more inclined towards CAA. Statistically significant differences between the attitudes of experienced students from different universities and different departments showed that students from university D and departments of Pharmacy were more positive towards CAA.

It was interesting to find that a simple majority (in Part 1) felt that 'the computer does not need to be used in tests or exams'. Additionally, a good majority of students in Part 2 stated that 'online systems of examination overburden students to prepare for exams', so teachers should avoid conducting this type of examination routinely. Furthermore, due to the uncertain and unexpected failure of technology during online examination, damage to students' could ensue, and 'CAA is not adequate to apply in Pakistan'.

Here, it is important to identify the two major administrative reasons of students' negative attitude towards CAA. Firstly: problems of load shedding (i.e., breakage in power supply) and secondly: lack of technical staff and insufficient number of computer systems in computer laboratories. Due to these major reasons, students were losing their confidence in online systems of examinations and believed that 'technology is not reliable'. In these situations, students preferred to take paper-based exams and tests. Researchers should help teachers and administrators to overcome these difficulties and make the online system of examinations interesting and valuable to all (students, teachers and academic staff). For example, it is clear from the literature that CAA is not an individual activity but requires collaboration between academic staff, supporting staff and administration (Bull, 1999). Bull further explained that CAA required a university-wide strategic approach and first piloting on

small scale, enabling evaluation of the process and the development of the appropriate strategies to implement on a larger scale.

The most prominent advantage observed during the survey was ‘immediate feedback saves student time’. In paper-based examinations students generally wait for a month (and some time more in the semester system) and more than 2 months (in the annual system) for their results. The most prominent disadvantage or limitation was the ‘impossibility of computer-based exams implementations in universities due to lack of resources and electricity failure problems.’

It was concluded that CAA is an interesting technique of assessment. However, technological problems made this system of examination unreliable. If administrators of institutions are interested to apply CAA properly, then it will be important to take preliminary steps to control unexpected technological problems. If they are successful in controlling these problems, all teachers, students and administrators will find CAA a most beneficial system of examination.

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## APPENDIX

 Table 1 - Calculated Values of  $\chi^2$  for Part 1

S. No.	Statements	$\chi^2$ ( $\alpha = 95\%$ )	Male & Female (df=4, 9.49)	Between different Universities (df=28, 41.34)	Between different Departments (df=44, 60.49)
1.	CAA is an interesting technique examination.	$\chi^2$ Sig.	11.89* 0.18	74.03* 0.000	169.79* 0.000
2.	Students should be trained to use computer for online tests/exams	$\chi^2$ Sig.	12.65* 0.013	92.23* 0.000	114.19* 0.000
3.	Interactive exercises help the students to improve marks.	$\chi^2$ Sig.	8.16 0.086	74.79* 0.000	94.94* 0.000
4.	Computer does not need to be used in tests or exams.	$\chi^2$ Sig.	0.56 0.968	58.27* 0.001	98.39* 0.000
5.	If choice is given to me to select one from online testing or traditional examination system; I will prefer the second one.	$\chi^2$ Sig.	13.56* 0.009	59.73* 0.000	101.13* 0.000
6.	I believe that CAA is not adequate in Pakistan.	$\chi^2$ Sig.	9.76* 0.045	54.01* 0.002	79.95* 0.001
7.	CAA may help to maintain standard of examination at international level.	$\chi^2$ Sig.	4.438 0.350	39.61* 0.072	121.84* 0.000
8.	Students should be given an opportunity to submit their assignments online.	$\chi^2$ Sig.	1.99 0.736	50.33* 0.006	122.51* 0.000
9.	CAA is a useless technique for me due to inadequate computer accessibility.	$\chi^2$ Sig.	14.63* 0.005	59.95* 0.000	111.13* 0.000
10.	CAA is a useless technique for me because I have no knowledge about it.	$\chi^2$ Sig.	17.14* 0.002	393.14* 0.000	441.92* 0.000
11.	CAA is the requirement of the time.	$\chi^2$ Sig.	8.09 0.088	187.38* 0.000	201.20* 0.000
12.	CAA should be implanted in all universities of Pakistan.	$\chi^2$ Sig.	6.29 0.178	220.11* 0.000	279.56* 0.000

 (\* - significant values of  $\chi^2$ )

**Table 2 - Calculated Values of  $\chi^2$  for Part 2**

S. No.	Statements	$\chi^2$ ( $\alpha = 95\%$ )	Male Female (df=4, 9.49)	Between Universities (df=28, 41.34)	Between Departments (df=44, 60.49)
1.	CAA is an interesting technique examination.	$\chi^2$ Sig.	4.71 0.319	57.58* 0.001	174.61* 0.000
2.	Online tests/exams always made me confused.	$\chi^2$ Sig.	25.99* 0.000	70.04* 0.000	126.38* 0.000
3.	CAA can improve students' achievements.	$\chi^2$ Sig.	4.25 0.373	55.69* 0.001	86.36* 0.000
4.	Minimum level of computer knowledge is enough to attempt the paper online.	$\chi^2$ Sig.	5.61 0.23	67.68* 0.000	126.98* 0.000
5.	CAA reduces tests/exam anxiety.	$\chi^2$ Sig.	5.94 0.204	82.05* 0.000	115.79* 0.000
6.	I believe that CAA is not adequate in Pakistan.	$\chi^2$ Sig.	6.86 0.143	59.69* 0.000	74.71* 0.003
7.	Interactive exercises help the students to improve the test/examination marks.	$\chi^2$ Sig.	11.30* 0.023	46.89* 0.014	115.68* 0.000
8.	CAA may help us to maintain our standard of examination at international level.	$\chi^2$ Sig.	5.15 0.272	37.39 0.110	100.67* 0.000
9.	CAA helps me to assess my-self.	$\chi^2$ Sig.	11.68* 0.020	38.61 0.087	64.62* 0.023
10.	Immediate feed back in online examination saves our time.	$\chi^2$ Sig.	2.287 0.683	66.09* 0.000	115.18* 0.000
11.	I always lose my confidence while solving the questions online.	$\chi^2$ Sig.	16.72* 0.002	39.99 0.066	92.55* 0.000
12.	I always prefer to take tests or exams online.	$\chi^2$ Sig.	8.25 0.083	45.08* 0.022	98.38* 0.000
13.	In online tests/exams, results are always unbiased.	$\chi^2$ Sig.	0.45 0.978	157.77* 0.000	118.55* 0.000
14.	Online tests/exams are much more secure than paper-based examination system.	$\chi^2$ Sig.	4.16 0.384	214.79* 0.000	202.07* 0.000
15.	Online examination technique overburdens the students, so it should be avoided by the teachers.	$\chi^2$ Sig.	1.77 0.779	151.49* 0.000	176.87* 0.000
16.	CAA damages thinking ability of student during test/exam time.	$\chi^2$ Sig.	14.67* 0.005	243.19* 0.000	308.58* 0.000

 (\* - significant values of  $\chi^2$ )