

# ***CAFAS: An automated computer aided assessment tool for providing student feedback and managing assessment information***

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## **Abstract**

The traditional way of providing feedback and assessment information to students is inefficient and is often ineffective at improving a student's ability to understand how to improve. With the development and proliferation of information technology, the process can be greatly improved with benefits for both teachers and students. Very few attempts have been made at developing such systems, and despite being readily available for over five years, such 'Computer Aided Assessment' (CAA) systems are rarely used in tertiary education. This paper reports the findings from initial trials of a second generation 'Computer Aided Feedback and Assessment System' (CAFAS), currently at the prototype stage, which is under development in the University of South Australia. The main aim of the system is to improve feedback and assessment methodologies by using information technology. It builds upon the beneficial aspects of CAA systems that have preceded it, and it overcomes their shortcomings. The main benefits of the new system are that it enables teachers from a broad range of disciplines to efficiently, effectively and consistently communicate feedback and assessment information to students in a format that students can readily understand and access. The rationale for the system, feedback from students undertaking courses in which the system has been trialled, and proposed further enhancements are discussed, and the benefits across a range of disciplines are outlined in this paper.

**Keywords:** feedback; assessment; electronic; marking; CAA.

## **Introduction**

The traditional way of providing feedback and assessment information to students is inefficient and is often ineffective at improving a student's ability to understand how to improve. With the development and proliferation of information technology, the process can be greatly improved with benefits for both teachers and students. Very few attempts have been made at developing such systems, and despite being readily available for over five years, such 'Computer Aided Assessment' (CAA) systems are rarely used in tertiary education. This is surprising given the main claims of the developers of these systems is that CAA enables teachers to provide higher quality feedback in a shorter amount of time (Denton, 2003). Short turn-around time and higher quality feedback have been identified as being essential for students to learn (Hounsell, 1997b). Notwithstanding that academics in higher education around the world are under significant pressure to perform (Coaldrake & Stedman, 1999), they have been slow to adopt the current assessment and feedback systems that offer efficiency, accuracy and improved learning outcomes.

A second generation 'Computer Aided Feedback and Assessment System' (CAFAS), currently at the prototype stage is under development in the University of South Australia. The main aim of the system is to improve feedback and assessment methodologies by using information technology. It builds upon the beneficial aspects of CAA systems that have preceded it, and it overcomes their shortcomings. It introduces novel functionality which, when combined with the beneficial aspects, results in a CAA system that will be embraced by teachers and students. The main outcome is that teachers will be able to provide better quality feedback and assessment in a shorter amount of time. The main outcome for students is that their opportunities to learn will be improved due to better quality feedback and assessment provided by their teachers. The system has been developed in response to the limitations of 'paper-based' feedback and assessment methods that are commonly

used in higher education and the lack of advanced ‘user-friendly’ CAA systems. The main outcome of the new system is that it will enable teachers in a broad range of disciplines to efficiently, effectively and consistently communicate feedback and assessment information to students in a format that students can readily understand and access.

### **Problems with existing methods for providing feedback**

The current popular method of providing extrinsic feedback and assessment is typically ‘paper-based’ (although there is a slow transition to online systems underway). Usually this takes the form of a printed A4 sized template or proforma that lists the ‘assessment criteria’ used to judge the academic performance demonstrated in the student’s ‘assignment’ (learning task). Typically, the teacher designs the proforma using a word processing tool such as Microsoft Word, prints out multiple copies (one for each student) and then rates the student’s efforts for each of the assessment criteria by indicating how many marks were attained for each criterion on an individual copy for each student. The teacher may also write individual comments for each of the criteria and a ‘summary comment’ in addition to recording an overall grade. Another form of extrinsic feedback may be provided by annotating (marking-up) the original work submitted by the student. This may be supplied in addition to the assessment proforma or, more commonly, in lieu of a proforma. Next, the teacher must record all the marks/grades from the each student’s proforma so that a final grade can be calculated at the end of the course. Then, the teacher must somehow return the assessment proforma to the student. A common way of doing this is to leave it somewhere to be collected (for example, the student’s pigeon hole, the school’s office, or the classroom), or return it to the student in person during the next class.

There are many problems with typical paper-based feedback and assessment methods:

- Students don’t understand their feedback or why they received a particular grade. They often query their feedback and/or assessment. This is because the proforma does not allow enough space for the teacher to write comments. Sometimes it is due to the teacher’s poor (hurried!) hand writing.
- Teachers have difficulty being consistent with assessment—namely, awarding grades based on performance measured against assessment criteria. It can be difficult for a teacher to consistently calculate without using a calculator to add up marks when multiple weighted assessment criteria need to be factored into calculating a final grade.
- It is difficult to moderate grades that have been generated by a variety of assessors.
- It takes a large proportion of the teacher’s time to provide feedback and assessment, which often may be simply misunderstood or, at worst is ignored or never collected.
- Frequently, providing feedback is tedious and boring, and hence not enjoyed, because it is repetitive in nature. For example, the same comment is often applicable to many of the students who have made the same error.
- Students don’t always access their feedback (for example, it is not collected from pigeon holes, school office, classroom etc).
- Feedback is not returned to students quickly enough for it to ‘feed-forward’ into the next learning task. Many staff have difficulty returning feedback and assessment within the time mandated by senior management.
- Occasionally staff make administrative errors when recording grades/marks.
- Records of feedback and assessment may not be kept by staff or students, despite the usefulness of such records for teachers in monitoring learning and validating final grades. For example, a teacher can refer to previous assessment proformas to check whether a student is repeatedly making the same mistake. It is especially useful to have records if there is a dispute regarding grades and academic performance. They are useful to students for informing their future learning activities. However, all too often paper-based assessment proformas are lost by students.

- Returning feedback and assessment proformas via students' pigeon holes, is problematic because students may not check them regularly. The same problem occurs when assessment proformas are left in a classroom or school office for students to collect. If proformas are handed to students in class, this consumes valuable class time. In addition, to some extent all of these paper-based feedback return systems may compromise the confidentiality of the students' grades.

The main aim of this new system is to improve learning outcomes of students by delivering detailed feedback and assessment to students electronically. The system provides teachers with a software tool that helps them design a feedback and assessment proforma for a specific assessment task. Once this has been achieved, teachers use the proforma digitally (as opposed the current norm of printing and writing on it) thereby overcoming many of the common problems mentioned previously.

### **Relationship to other research**

The field of computer aided feedback and assessment is relatively new and very few systems are currently available. The literature refers to this field as 'Computer-Aided Marking' (Sondergaard & Thomas, 2004) or 'Computer Assisted Assessment' (Denton, 2003). Denton (2003) outlines four main types of Computer Assisted Assessment: (1) Objective Testing such as multiple choice or text match type questions delivered via the Web; (2) Electronic Submission enabling students presenting work to their tutor via email or threaded discussions that enable students to contribute to an on-line debate; (3) Free Text Analysis including plagiarism detection tools that can be used to check for similarities between electronic text files and software designed to automatically grade free text; and (4) Marking Assistants that can aid in the computation of student marks.

CAFAS fits into the last category of 'Advanced Marking Assistant'. However, its functions are not limited to generating written feedback reports (for example, it has the ability to embed audio recordings of feedback). Denton of Liverpool John Moores University has developed a system called 'Electronic Feedback', which utilises Microsoft Office applications (Word, Excel) to provide written feedback and assessment results in text format (Denton, 2003). 'Mindtrail'® by Mindtrail Software Pty Ltd also returns feedback and assessment results in text format (Cargill, 2001). While these systems have demonstrated many advantages especially in terms of students' learning outcomes (Denton, 2003; Sondergaard, 2004; Jamison & Stevens, 2002), ultimately they have failed to become widely accepted in higher education. Indeed Mindtrail Software Pty Ltd was liquidated in 2002, which has curtailed some research studies (Jamieson et al., 2002; Cargill, 2001). This may be because there are major obstacles for teachers who want to use these systems. Denton's system is difficult to initially install and set up and is limited to one particular assessment regime. 'Mindtrail' has been criticised for being poorly designed and time consuming to set up (Jamieson et al., 2002). By contrast, trials undertaken by the authors in 2006 show that teachers who are unfamiliar with CAFAS but proficient in the use of spreadsheet software, can quickly install and learn how to use it effectively.

Functionally the CAFAS performs the same core functions as 'Mindtrail' and 'Electronic Feedback'. It has been developed as a prototype application using Excel spreadsheet software and runs on both Windows and MAC platforms (although there are some limitations on the MAC platform relating to the use of macros). While the system is relatively easy to master using Excel, teachers do need to be proficient in the use of spreadsheet software in the initial set up stage. However, the intention is to custom develop the tool using open source software to ensure the entire application is relatively easy to use, even for the novice computer user. In its current prototype version, CAFAS creates a report of text comments and calculates an overall mark and grade based on weighted assessment criteria using formulas based on the weighted scores entered by the teacher.

The tool also performs functions that the others do not. For example, CAFAS provides the ability to embed audio recordings of feedback, to graphically display learning outcomes via graphs, to graphically display performance outcomes via performance continuum scroll bars, and to display grade descriptors and checklists of 'deliverables' and 'penalties'. Final output of student feedback is in PDF format, which is then distributed to students electronically. It is these novel features and 'user-friendly' interface that are likely to appeal to academics throughout the higher education sector.

Many universities are exploring and developing their own CAA systems but these are in relation to the first three types outlined by Denton (2003): Objective Testing, Electronic Submission and Free Text Analysis. For example, the University of South Australia already has systems that address the first three categories but not a 'Marking Assistant' (with the exception of the limited use of the CAFAS prototype).

### **Teaching and learning benefits**

The current CAFAS prototype addresses many important aspects of assessment and feedback. These are discussed in the following sub-sections.

#### ***Online Assessment***

Online assessment is integral to the system. Denton (2003), inventor of 'Electronic Feedback', has shown that using email to provide feedback online is advantageous. As he explains "Surveys of students indicate that they appreciate receiving feedback via email, even in the absence of their original script". These findings have been corroborated in recent trials undertaken by the authors in 2006. Many students reported that the online delivery of feedback via CAFAS was greatly appreciated due to the convenience of accessing and storing feedback/assessment and for the quality of feedback. In response to the question "*Digital Feedback and Assessment Sheets were emailed to you (PDF file) for each assessment. What are the benefits/disadvantages of this new system for providing feedback and calculating assessment?*" students commented:

"Very clear, can see exactly where you lost marks, which is helpful to know what you need to improve on".

"Convenience — I can receive them at home instead of going to Uni. Detailed comments were great, so were the graphs".

"Very beneficial — detailed exactly where strengths/weaknesses were".

"This was a really good method of feedback. They provided in depth explanation of all facets of the assignments which enabled you to see exactly where you went wrong, or what could be improved".

"It was fantastic to receive such comprehensive feedback. Since I spent a lot of time on ensuring my assignments were at a high standard, it was nice to know that course staff made the effort to undertake a detailed review of my assignments and provide valuable feedback".

"This was very beneficial and excellent feedback! Just having a single comment and a score isn't very helpful, but having this digital feedback explains every assessment criteria, as well as percentage weightings, the grade and comments. This feedback should be kept this way".

"This was genuinely useful in seeing where criteria was and wasn't met and what to improve or look out for in future assessments".

"Yes, this was a new way of providing feedback to students. The assessment sheets themselves were very comprehensive and allowed for thorough, detailed feedback, which is greatly appreciated. I think overall, the system was beneficial to students, it was just different to see graphs and charts on a marking sheet. Different, but comprehensive = good".

### *Assessment of large classes*

Assessment of large classes is improved by two mechanisms: (1) large classes are often assessed by multiple tutors – this raises the issue of consistency of assessment. This issue is addressed by a ‘moderation’ function which enables the course coordinator to quickly adjust the grades of a group of students which were assigned by a particular tutor (for example, in the event that a tutor has been ‘too harsh’ or ‘too soft’ in their assessment of student work); (2) a list of standard feedback comments can be generated by the ‘marking team’ or course coordinator prior to assessment. This enables all members of the marking team to rapidly and consistently supply feedback to students via drop-down menus (or similar). More specific, personalised feedback can also be entered as necessary and new ‘standard comments’ can be added ‘on-the-fly’ during the assessment process.

### *Assessing post-graduate students*

The CAFAS uses a criterion-based assessment system which is commonly used to assess Course-work Post-Graduate students in the Louis Laybourne Smith School of Architecture & Design. The online nature of the system enables multiple assessors who may be in different locations (for example, remote rural locations or different cities) to easily collaborate on assessment of Post-Graduate students. Feedback to Post-Graduate students is often more detailed and this can be accommodated by the expandable ‘Comments’ text entry fields on the CAFAS proforma.

### *Minimising academic misconduct*

Although not the main focus of CAFAS, the system has the potential to assist with deterring students from engaging in academic misconduct such as plagiarism. By default, the CAFAS proforma includes a ‘Penalty’ field titled ‘Academic Misconduct’. This acts as a reminder to staff and a warning to students; staff must discuss and explain this important issue with students, and, students are warned that academic misconduct is a serious issue – by default a 100% penalty is stipulated for academic misconduct.

### *Developmental, diagnostic and summative assessment and feedback*

The CAFAS system enables academic staff to efficiently and consistently provide developmental, diagnostic and summative feedback and assessment to students via online methods (for example, email or website). The current embodiment of the CAFAS prototype is designed to enable staff to document feedback/assessment via eight interrelated mechanisms:

1. ‘performance continuum’ for each assessment criterion – basic developmental/diagnostic
2. ‘comments’ field for each assessment criterion and for ‘Deliverables’ and ‘Grade Penalties’ checklists – detailed developmental/diagnostic
3. ‘summary comments’ field – detailed developmental/diagnostic
4. an overall grade – summative feedback (‘assessment’)
5. an assessment criterion descriptor field – developmental/diagnostic
6. a performance indicators graph (with editable descriptor fields) – generic developmental/diagnostic
7. a list of grade descriptors (with editable descriptor fields) – generic developmental/diagnostic
8. a ‘class feedback’ sheet – developmental/diagnostic

### **Future developments**

In its current prototype format, CAFAS provides a variety of mechanisms for providing feedback and assessment. This enables the academic to intelligently choose and use the appropriate

mechanisms to provide feedback and assessment that is suitable for the learning task (assignment) that is being assessed and the discipline that is being taught. Consequentially, students receive a feedback and assessment proforma which is very rich with information in formats that they can access and understand easily, and which they can keep for future reference. This enables students to learn more effectively.

The system has been trialled with students in three courses and the feedback obtained through course evaluation questionnaires indicates positive acceptance of the approach. Anecdotal reports by teaching staff involved in the trials suggest that the tool expedites the assessment and feedback process, enabling staff to provide detailed feedback in a timely manner. Formal evaluations involving academic staff are planned to assess the overall acceptance of the tool by teachers, and to determine the extent to which teachers perceive that the criterion based system produces final grades that are consistent with the grades that would have been obtained using a traditional approach to assessment. Once these evaluations have been completed, the prototype will be modified on the basis of feedback obtained and developed into a custom application using open-source software.

## **Conclusion**

CAFAS has many advantages for higher education. The online system is efficient which will assist with reducing heavy workloads of teachers and improving student satisfaction and learning outcomes via reduced turn-around times. Mechanisms for improving consistency of feedback and assessment, and for moderation of grades will facilitate collaboration between multiple markers (teachers) and ensure that the calculation of students' marks is as fair as practicable. It offers students the benefits of clearly understanding the assessment regime by spelling it out using easily understood graphs, scroll-bars, tick boxes, and text entry boxes. It provides the convenience of receiving feedback in digital format and the flexibility to be used as both a formative and summative assessment tool.

## **Notes on contributors**

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