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Online Metacognitive Tool Development: Final Development

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The authors of this paper have been developing an online metacognitive tool over the past four years through a process of iterative design and development stages using Design-Based research. Based on feedback from students, tutors and peers, the application has now been finally developed and is available for public download. The application helps students working in teams reflect on their learning strategies through a process of planning, monitoring and evaluation, and allows students to reflect on their performance.

Introduction

Pressure is being applied to higher education institutions by government funding authorities and industry to produce graduates able to enter industry immediately at a technical level but also adapt as the industry evolves. The Employability Skills Framework (DEST 2006), defines eight employability skills – communication, teamwork, problem solving, self-management, planning and organising, technology, life-long learning, and initiative and enterprise, and 13 personal attributes that are considered important not only to gain a job, but also important for current employees to progress with an organisation. However a recent study of higher education institutions has shown that these are not developed in a consistent manner (Barrie, 2006).

Authentic, interactive tasks are required in which students negotiate roles, reflect on their performance and are motivated to complete the work, because of its intrinsic value. This paper describes the cumulative efforts in addressing this issue over several years of research and development. A learning environment is outlined here where students are required to form teams and develop products for real clients, which conform to industry standards. This learning environment, JAMTART, addresses key generic skills inherent in teamwork. This product has been developed using design-based research through evolutionary cycles of development.

Developing JAMTART Through Design-Based Research

JAMTART was developed within a design-based research framework. This is a narrowly focused approach to research in that it leads to the implementation of a real product that has a specific purpose. At the same time, this implementation is used as a means of testing broader theory (The Design-Based Research Collective, 2003). Objectivity is less important to this approach to research in that it acknowledges the ‘messyness’ of real educational settings and aims to explore the impact of the research within these. Since the variables inherent in authentic settings cannot be controlled in the same way as experimental settings, the aim is to develop a rich qualitative picture of the affects of the research rather than to test individual hypothesis.

Key to this approach also, is a cyclical process of revision following initial implementation, and the notion of the researcher as integral to the process rather than a neutral observer. Given that the purpose of the research was to develop a solution to a learning problem through the design of an innovative product, it is therefore a highly appropriate methodology here. The research was grounded in an actual class of undergraduate students who used the product as part of their day-to-day engagement in their course of study. Therefore a prescriptive methodology was difficult to identify. Nevertheless an approach was developed that used an ‘integrative learning design framework’ as proposed by Bannan-Ritland (2003) that identified a four stage model to provide a course of action: informed exploration, enactment, evaluation: local impact and evaluation: broader impact.

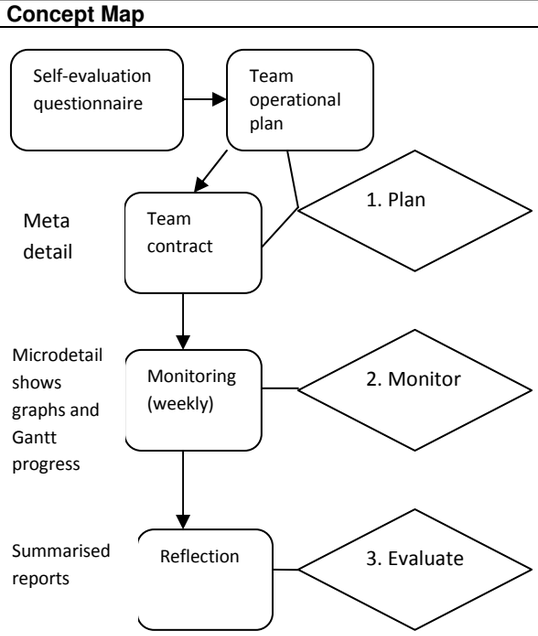
Over the past four years JAMTART has been evolving through a series of iterative designs and developments with a view to promote students' metacognitive processing abilities. Design-based research (Luca & McMahon, 2006; McMahon & Luca, 2005) has been used to inform its development, and the final version has now been developed.

JAMTART is grounded in a previously proposed model for the metacognitive regulation of thinking processes (McMahon & Luca, 2007), key to which is the notion of self-monitoring as the bridge between the task and skill development, with planning, monitoring and evaluation as the underpinning activities. In order to explore this, students from of Edith Cowan University's (ECU) Bachelor of Creative Industries in Interactive Media Development were used to test the application through a number of cycles.

When these students graduate, they are typically required to follow an industry model based on small teams developing products for clients, which is heavily reliant on the generic skill of teamwork! They are required to develop and understand their role in the team, monitor their performance as they contribute to the overall team effort and then evaluate their performance with a view to further improving their performance. Therefore, our goal was to develop a tool that would help students plan, monitor and then reflect on their teamwork skills through the semester, as well as getting feedback from their peers. t. Such assessment involves students making judgments about their own learning and that of others, which contributes to the development of autonomous, responsible and reflective individuals (Sambell, McDowell, & Brown, 1998; Schon, 1987). JAMTART was developed as the means to achieve this by tracking a student's progress through the life of a development project, and engage them in the above processes.

JAMTART is open source software now freely available at http://sandbox.ea.ecu.edu.au/projects/jamtart/ and developed with administration, tutor and student views. Educators will have the flexibility to setup assessment criteria through the use of a wizard to help contextualise the tool to any discipline (Table 1).

Table 1: JAMTART Modules and Tools

Tools	**Concept Map**
Self-assessment: • *Self-assessment questionnaire*, provides feedback on skills and attributes to help students make meaningful decisions regarding team roles and responsibilities • *Team operational plan*, based on the self-assessment questionnaire, as well as students' career aspirations. Outlines operational guidelines the team follows and negotiated performance criteria for each task. • *Student Contract* identifies student responsibilities in the team. Allow students to clearly state what major roles and responsibilities they will take.	
Team monitoring Each week, students enter their actual progress & performance (time, percent complete, quality and comments). This is compared to their estimated progress and performance as stated in the contract. This information is summarised and presented in graphical and tabular format to show how their roles and contributions within the team are evolving. This section concentrates on micro tasks that are related to macro tasks outlined in the student contract.	
Reporting and Reflection Shows summarised data such as comments, personal reflections and rationales for changes in estimations that evolved during the semester, and acts as a prompt for students to evaluate their overall performance. W*hy* did some tasks go off track, and others were successful? Lessons learnt, skills that need enhancing and also areas of strength that can be carried forward in career options.	

The Final Product

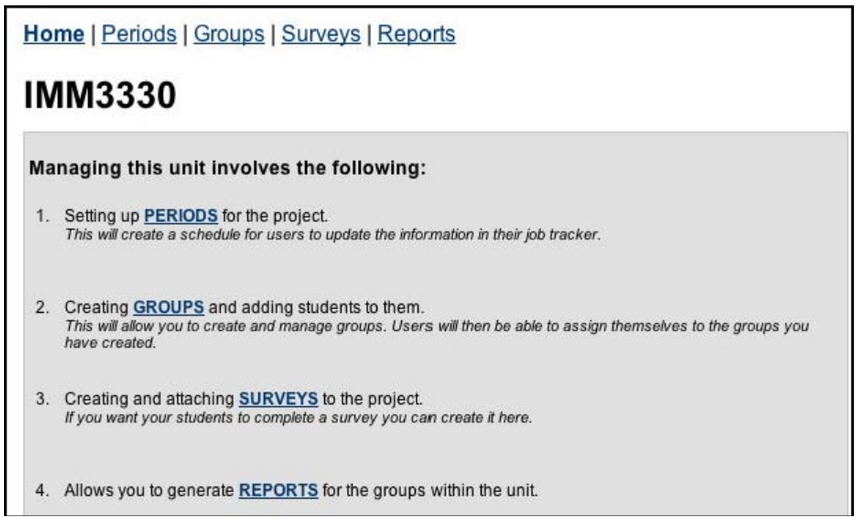
In the final product, key metacognitive features of planning, monitoring and evaluation are fore-grounded in a more user-centric approach with 'My surveys', 'My progress', 'My group' and 'My portfolio' (Table 2). Alos, there are two wizards built into the system that promote the logical sequences involved in using the product. An example of this is the Unit Wizard. This allows the tutor to set up standard workflows for the students in a way that articulates the stages involved in engaging in the planning monitoring and evaluation of learning. Using a design-based research approach helped identify these requirements to make the produce more user-friendly and usable.

Table 2: Redesigned structure of JAMTART

Access	**Feature**	**Description/Contents**
Administrator View	*Unit Management*	Add and edit unit details -*Unit Code, Unit Title & Unit Overview*
Tutor View	*Unit Creation* ***WIZARD***	Takes tutors through each of the four stages: 1. Periods -number of sessions needed for the project eg 12 weeks 2. Number of groups and size of each group 3. Surveys -Create and edit dimensions, statements, feedback for certain types of results, and rules 4. List of reports with checkboxes showing student plans, actual times, and reflections. Reports selected here will be made available to the students
	Group Summaries	Clicking on the individual groups will allow the tutor to see: • Feedback for each member of the group • Job cards page (viewable but not editable) • Report results for each group or individual
	Student Management	• Student name, student number & email
Student View	*Unit Access* ***WIZARD***	Students taken through a logical progression of: 1. *My Surveys* -Allow students to complete or view results 2. *My Group* -view group members, join a group, select a role etc 3. *My Progress* -view schedule and job cards 4. *My Portfolio* -select reports & view portfolio

From the administrator and tutor's point of view, a clear process for the setting up of the environment with a focus on the learning process rather than the individual toolset is now evident (Figure 1)

Figure 1: Unit Creation Wizard



Similarly, students are now able to able to use the product in a way that is more oriented towards their learning journey. This is demonstrated in Figure 2, which provides an overview of the various components that can be undertaken or reviewed in a logical and holistic manner.

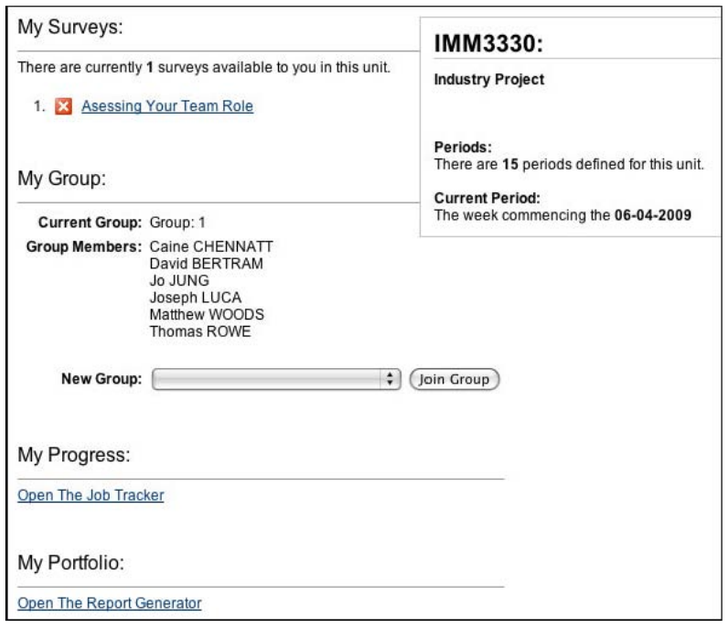
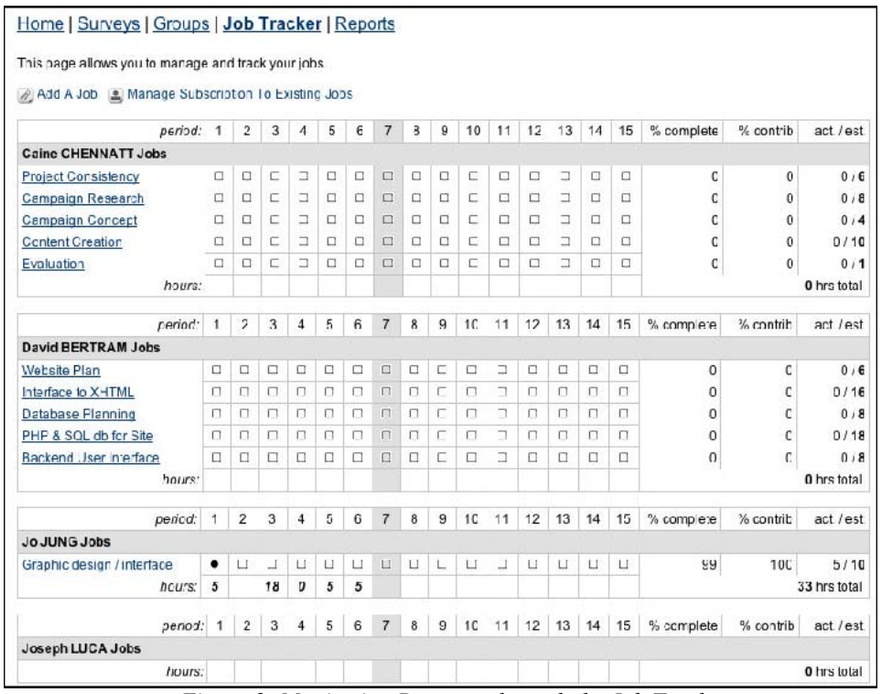


Figure 2: Unit Access Wizard

Students can therefore use the self-assessment survey as the basis of allocating themselves to a group, review their progress through the job tracker with *My Progress* (Figure 3).



Home | Surveys | Groups | **Job Tracker** | Reports

This page allows you to manage and track your jobs

Add A Job Manage Subscription To Existing Jobs

period:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	% complete	% contrib	act / est
Caine CHENNATT Jobs																		
Project Consistency	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	0	0	0 / 6
Campaign Research	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	0	0	0 / 8
Campaign Concept	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	0	0	0 / 4
Content Creation	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	0	0	0 / 10
Evaluation	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	0	0	0 / 1
hours:																		**0** hrs total

period:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	% complete	% contrib	act / est
David BERTRAM Jobs																		
Website Plan	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	0	0	0 / 6
Interface to X-HTML	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	0	0	0 / 16
Database Planning	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	0	0	0 / 8
PHP & SQL db for Site	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	0	0	0 / 18
Backend User Interface	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	0	0	0 / 8
hours:																		**0** hrs total

period:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	% complete	% contrib	act / est
JoJUNG Jobs																		
Graphic design / interface	●	□	□	□	□	□	□	□	□	□	□	□	□	□	□	99	100	5 / 10
hours:	**5**		**18**	**9**	**5**	**5**												**33** hrs total

period:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	% complete	% contrib	act / est
Joseph LUCA Jobs																		
hours:																		**0** hrs total

Figure 3: Monitoring Progress through the Job Tracker

Students enter jobs to be completed and their nominal due dates, propose the hours required for each job and then match them to their actual performance throughout the periods that have been defined. The continual monitoring that takes place as they do this then culminates in students' evaluations of their performance

To facilitate this, students return to the Unit Access Wizard to the My Portfolio section, which generates a range of reports that summarises their work throughout the semester. This can serve as a basis for assessment of teamwork, but more importantly closes the self-assessment loop as part of the metacognitive approach to the development of Teamwork skills that underpins the overall design of JAMTART. Also, a number of reports are available to both students and tutors at any stage (Figure 4).

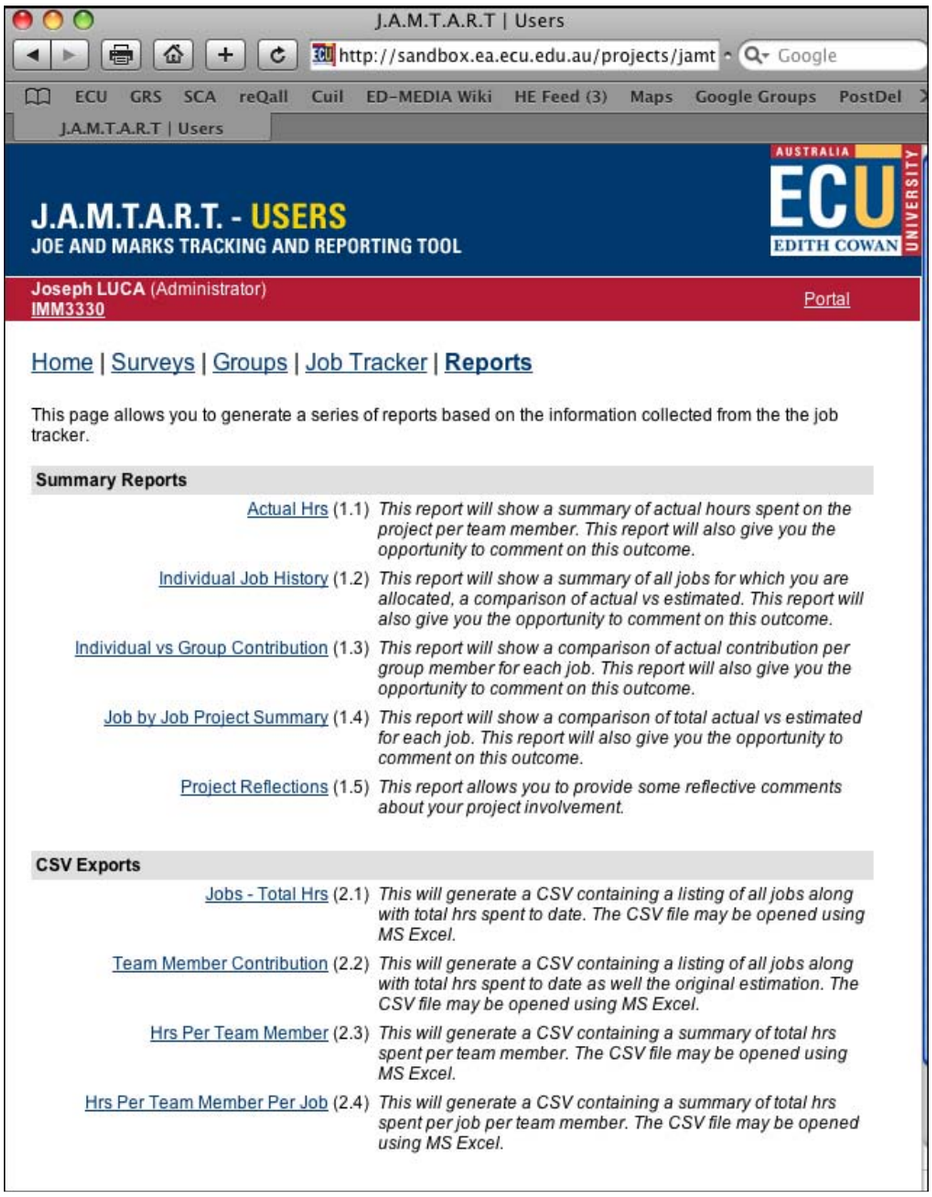


Figure 4: Report Options

Conclusions

The learning environment discussed in this paper is the aggregated outcome of several iterations that went through evaluation and redesign over a number of years using Design-Based research. The final development described in this paper provides a strong user-centric focus to help empower students reflect on their learning experiences as they perform development tasks.

The produce is now available for free download at http://sandbox.ea.ecu.edu.au/projects/jamtart/.

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