



# **THE IMPACT OF THE CONSTRUCTION COMPUTING SOFTWARE (CCS) ‘CANDY’ COURSE: CONSTRUCTION MANAGEMENT STUDENTS’ PERCEPTIONS**

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Students’ post-course perceptions provide insight relative to their understanding and appreciation of a module, including the impact thereof within the context of the wider course content, hence the study ‘Construction management students’ post course perceptions regarding a CCS Candy course’ presented at a South African university. The salient findings include: ‘planning – programming’ predominates in terms of the extent Candy training contributed to an increase in knowledge; costing and estimating predominate in terms of an enhancement of skills; coordinating predominates in terms of contributing to an improvement in students’ understanding and appreciation of the functions of management work, and cost predominates in terms of an improvement in students’ understanding and appreciation of the project parameters. Conclusions include that the CCS Candy course had an impact in terms of: an enhancement of both knowledge and skills aligned with the planning function; a better understanding and appreciation of the practice of construction management, and students understand and appreciate the importance and role of the course in terms of greater knowledge development. It is recommended that the ‘add-on’ certificated CCS Candy course continue to be included and that the research be conducted annually.

*Keywords:* Estimating, Planning, Commercial packages, Education, Students.

## **1 INTRODUCTION**

The Department of Construction Management at Nelson Mandela University endeavors to provide relevant and learner centered education in the discipline, develop the necessary competencies, thereby empowering graduates to integrate into the industry as construction managers, and construction project managers. Specialist planning skills education was identified as an area that needed greater focus within the department, and as a result it was decided to align the department with the most widely used planning and estimating package in the South African construction industry, namely CCS Candy. The CCS Candy system is used to control a projects construction process and financial performance from tender stage to the final account stage. Candy has a planning application, but is much more than a planning and estimating package due to its dynamic link between money and time providing a wealth of information for both management and clients (CCS Candy 2013). The subject matter of the course has become highly topical with greater emphasis being placed on the use of software for the planning and estimating of construction projects, with greater interest being shown from commercial entities in students

having a practical certification of competency alongside their theoretical knowledge garnered during the degree programme. By engaging with the external training provider of the software supplier, the department has been able to structure the course content to better align students basic understanding of the built environment processes with a more holistic overview of the use of software to deliver projects, simultaneously providing a certificated additional module and a certification that provides those who complete the course a ready entry into the labor market. Given the aforementioned, a study was conducted to determine the impact of the course.

## **2 REVIEW OF THE LITERATURE**

Wickramasinghe and Perera (2010) contend that the possession of subject skills alone is no longer sufficient for a new graduate in meeting employer requirements. Finch *et al.* (2016) state that 40 percent of employers believe that there is a significant skills gap between graduates and requirements, and therefore providing students with the right skills to fill those gaps becomes fundamental for tertiary education as well as construction. Employability of an individual depends upon knowledge, skills, and attitudes, which requires that tertiary education needs to produce quality graduates that employers want to include in their graduate programmes (Wickramasinghe and Perera 2010). Student perceptions of a course's merit can be influenced by many factors, with studies conducted across multiple disciplines showing that "engagement, perceived course value, and the use of deep learning strategies" are all 'integral to a student's positive learning experience' (Floyd *et al.* 2009). Positive learning experiences in turn are likely to lead to positive reinforcement of a course among the student body, relating the perception through deeper learning to the course content becomes a fundamental means to influencing that perception. According to Liu *et al.* (2012), motivation is a key factor in student learning, and Kamardeen (2013) states that self-motivation of students is a prime requirement for their active engagement, which means that the course content needs to stimulate interaction within the study sessions, and into other courses within each discipline's course structure.

## **3 RESEARCH METHOD**

The two-day certificate CCS Candy course is an additional intervention included in the BSc (Construction Studies) programme relative to the subject Construction Management 3. To assess the impact of the CCS Candy course, students were surveyed immediately upon completion thereof to determine the extent to which the CCS Candy training contributed to an: increase in knowledge; enhancement of skills; improvement in understanding and appreciation of the functions in an organisation, the functions and activities of management work, the various project parameters, and built environment processes, and the construction process and activities, and the integration of subjects. The questionnaire consisted of 7 closed-end questions, 97 sub-questions, and 1 open-end question. The closed-end questions entailed a response to a five-point Likert scale preceded by an 'unsure' and 'did not' contribute option. Therefore, respondents effectively responded to a six-point Likert scale. Based upon the number of responses to the six points, a measure of central tendency in the form of a mean score (MS) was computed to enable a relative comparison and rankings. Due to an effective six points on the scale, the MS ranges from 0.00 to 5.00, with a midpoint of 2.50. 15 Students' responses were included in the analysis of the data.

## **4 RESEARCH FINDINGS**

Table 1 indicates the extent to which the Candy training contributed to an increase in knowledge relative to thirty knowledge areas in terms of percentage responses to a scale of 1 (minor) to 5

(major), and MSs between 0.00 and 5.00. It is notable that all the MSs are  $> 2.50$ , which indicates that the contribution of the Candy training to an increase in knowledge is major as opposed to minor. Given that effectively a six-point scale ('did not' linked to a five-point) was used, and that the difference between 0 and 5 is five, ranges with an extent of 0.83 ( $5 / 6$ ) are used to discuss the degree of central tendency.  $13 / 30$  (43.3%) MSs  $> 4.17 \leq 5.00$ , which indicates that the Candy training made between a near major to major / major contribution to an increase in knowledge. The knowledge areas include 'planning – programming', 'cost control', 'planning – strategic', 'estimating', 'project management', 'measuring (quantities)', 'plant and equipment management', 'materials management', 'cost engineering', 'productivity', 'risk management', and 'procedures', except for 'planning – strategic', these findings are not unexpected.  $16 / 30$  (53.3%) MSs  $> 3.33 \leq 4.17$ , which indicates that the Candy training made between a contribution to a near major / near major contribution to an increase in knowledge.

Table 1. Extent to which the Candy training contributed to an increase in knowledge relative to thirty knowledge areas.

Knowledge area	Response (%)							MS	Rank	
	U	Did not	Minor .....							Major
			1	2	3	4	5			
Planning - programming	0.0	0.0	0.0	0.0	0.0	26.7	73.3	4.73	1	
Cost control	0.0	0.0	0.0	0.0	0.0	30.8	69.2	4.69	2	
Planning - strategic	7.1	0.0	0.0	0.0	0.0	42.9	50.0	4.54	3	
Estimating	0.0	0.0	0.0	0.0	13.3	20.0	66.7	4.53	4	
Project management	0.0	0.0	0.0	0.0	7.1	35.7	57.1	4.50	5	
Measuring (quantities)	0.0	0.0	0.0	6.7	6.7	26.7	60.0	4.40	6	
Plant and equipment management	0.0	0.0	0.0	0.0	15.4	30.8	53.8	4.38	7	
Materials management	0.0	0.0	0.0	0.0	6.7	53.3	40.0	4.33	8	
Cost engineering	0.0	0.0	0.0	0.0	6.7	53.3	40.0	4.33	9	
Productivity	0.0	0.0	0.0	0.0	6.7	60.0	33.3	4.27	10	
Risk management	0.0	0.0	0.0	0.0	13.3	46.7	40.0	4.27	11	
Procedures	0.0	0.0	0.0	6.7	0.0	53.3	40.0	4.27	12	
Cash flow forecasting	0.0	0.0	6.7	0.0	13.3	26.7	53.3	4.20	13	
Training	0.0	0.0	0.0	0.0	26.7	33.3	40.0	4.13	14	
Benchmarking	13.3	0.0	0.0	0.0	26.7	26.7	33.3	4.08	15	
Final accounts	6.7	0.0	0.0	6.7	6.7	53.3	26.7	4.07	16	
Materials	0.0	0.0	0.0	0.0	26.7	40.0	33.3	4.07	17	
Specifications	0.0	6.7	0.0	0.0	6.7	53.3	33.3	4.00	18	
Methods (construction) - building	0.0	0.0	0.0	0.0	30.8	38.5	30.8	4.00	19	
Human resources	0.0	0.0	0.0	7.7	23.1	30.8	38.5	4.00	20	
Methods (construction) - civil	6.7	0.0	0.0	0.0	33.3	33.3	26.7	3.93	21	
Remuneration	7.1	7.1	0.0	0.0	21.4	21.4	42.9	3.92	22	
Financial management	7.1	7.1	0.0	0.0	21.4	21.4	42.9	3.92	23	
Subcontractor management	0.0	0.0	0.0	7.7	38.5	30.8	23.1	3.69	24	
Work study	7.1	7.1	0.0	0.0	35.7	21.4	28.6	3.62	25	
Purchasing	0.0	6.7	0.0	13.3	20.0	26.7	33.3	3.60	26	
Information technology	7.1	7.1	0.0	7.1	7.1	35.7	35.7	3.57	27	
Design	13.3	6.7	0.0	6.7	13.3	46.7	13.3	3.54	28	
Contract documentation	0.0	6.7	0.0	20.0	20.0	26.7	26.7	3.40	29	
Management (business)	13.3	6.7	0.0	13.3	0.0	40.0	26.7	3.20	30	

Only  $1 / 30$  (3.3%) MSs  $> 2.50 \leq 3.33$ , which indicates that the Candy training made between a near minor contribution to a contribution / contribution to an increase in knowledge – 'management (business)'.

Table 2 indicates the extent to which the Candy training contributed to the enhancement of twenty-seven skills in terms of percentage responses to a scale of 1 (minor) to 5 (major), and MSs between 0.00 and 5.00. It is notable that all the MSs are > 2.50, which indicates that the contribution of the Candy training was major as opposed to minor. 14 / 27 (51.9%) MSs > 4.17 ≤ 5.00, which indicates that the Candy training made between a near major to major / major contribution – ‘costing’, ‘estimating’, ‘planning’, ‘computer’, ‘organising’, ‘measuring – productivity’, ‘financial’, ‘controlling’, ‘procedures development’, ‘coordinating’, ‘initiating’, ‘technical’, ‘systems development’, and ‘decision making’, which are not unexpected as CCS Candy is planning focused and estimating oriented. 9 / 27 (33.3%) MSs > 3.33 ≤ 4.17, which indicates that the Candy training made between a contribution to a near major / near major contribution. ‘Supervisory’ is followed by ‘training’, ‘measuring – quantities’, ‘motivating’, ‘statistical’, ‘administrative’, ‘auditing’, ‘communicating – graphic’, and ‘negotiating - plant hire’. 4 / 27 (14.8%) MSs > 2.50 ≤ 3.33, which indicates that the Candy training made between a near minor contribution to a contribution / contribution – ‘work study’, ‘communicating – written’, ‘plan reading’, and ‘negotiating – subcontractors’.

Table 2. Extent to which the Candy training enhanced twenty-seven skills.

Skill	Response (%)							MS	Rank
	U	Did not	Minor .....Major						
			1	2	3	4	5		
Costing	0.0	0.0	0.0	0.0	7.1	7.1	85.7	4.79	1
Estimating	0.0	0.0	0.0	0.0	7.1	14.3	78.6	4.71	2
Planning	0.0	0.0	0.0	0.0	6.7	20.0	73.3	4.67	3
Computer	0.0	0.0	0.0	0.0	0.0	35.7	64.3	4.64	4
Organising	0.0	0.0	0.0	0.0	6.7	33.3	60.0	4.53	5
Measuring - productivity	0.0	0.0	0.0	0.0	0.0	50.0	50.0	4.50	6
Financial	0.0	0.0	0.0	0.0	7.1	35.7	57.1	4.50	7
Controlling	0.0	0.0	0.0	0.0	20.0	13.3	66.7	4.47	8
Procedures development	0.0	0.0	0.0	0.0	21.4	14.3	64.3	4.43	9
Coordinating	6.7	0.0	0.0	0.0	0.0	26.7	66.7	4.40	10
Initiating	0.0	0.0	0.0	0.0	7.1	50.0	42.9	4.36	11
Technical	0.0	0.0	0.0	0.0	13.3	46.7	40.0	4.27	12
Systems development	7.1	0.0	0.0	0.0	0.0	42.9	50.0	4.21	13
Decision making	0.0	0.0	0.0	0.0	6.7	66.7	26.7	4.20	14
Supervisory	0.0	0.0	0.0	0.0	20.0	46.7	33.3	4.13	15
Training	0.0	0.0	0.0	0.0	33.3	26.7	40.0	4.07	16
Measuring - quantities	0.0	6.7	0.0	6.7	6.7	26.7	53.3	4.07	17
Motivating	6.7	0.0	0.0	0.0	26.7	13.3	53.3	4.00	18
Statistical	7.1	0.0	0.0	0.0	14.3	42.9	35.7	3.93	19
Administrative	8.3	0.0	0.0	8.3	0.0	41.7	41.7	3.92	20
Auditing	7.1	0.0	0.0	0.0	21.4	42.9	28.6	3.79	21
Communicating - graphic	0.0	8.3	0.0	8.3	16.7	33.3	33.3	3.67	22
Negotiating - plant hire	8.3	8.3	0.0	0.0	25.0	8.3	50.0	3.58	23
Work study	14.3	7.1	0.0	0.0	14.3	35.7	28.6	3.29	24
Communicating - written	8.3	8.3	0.0	8.3	25.0	25.0	25.0	3.17	25
Plan reading	6.7	20.0	0.0	6.7	13.3	20.0	33.3	3.00	26
Negotiating - subcontractors	7.7	23.1	0.0	15.4	7.7	23.1	23.1	2.62	27

Table 3 indicates the extent to which the Candy training contributed to an improvement in understanding and appreciation of the functions and activities of management work. It is notable that all the activities of the planning, organising, leading, and controlling functions of management work and the coordinating function have MSs > 2.50, which indicates that the

Candy training contributed to more of a major than a minor improvement. In terms of the functions, based upon the mean MSs, coordinating (4.50) achieved the first ranking followed by planning (4.42), controlling (4.09), leading (3.96), and organising (3.72). These findings were expected. It is notable that scheduling (4.79) is ranked first in terms of the function of planning, and overall. Overall, it is followed by programming (4.71), correcting performance (4.50), coordinating (4.50), forecasting (4.43), communicating (4.43), performance measuring (4.43), decision-making (4.36), developing performance standards (4.36), evaluating performance (4.36), budgeting (4.29), developing objectives (4.29), developing procedures (4.21), and developing organization structure (4.21), which all have MSs  $> 4.17 \leq 5.00$ , MSs  $> 4.17 \leq 5.00$ , which indicates that the Candy training made between a near major to major / major contribution to an improvement in understanding and appreciation of functions and activities of management work.

Table 3. Extent to which the Candy training contributed to an improvement in understanding and appreciation of the functions and activities of management work.

Function / Activity	Response (%)							MS	Rank	
	U	Did not	Minor .....							Major
			1	2	3	4	5			
<b>Planning:</b>										
Scheduling	0.0	0.0	0.0	0.0	0.0	21.4	78.6	4.79	1	
Programming	0.0	0.0	0.0	0.0	7.1	14.3	78.6	4.71	2	
Forecasting	0.0	0.0	0.0	0.0	7.1	42.9	50.0	4.43	5	
Budgeting	7.1	0.0	0.0	0.0	0.0	35.7	57.1	4.29	11	
Developing objectives	0.0	0.0	0.0	0.0	14.3	42.9	42.9	4.29	12	
Developing procedures	0.0	0.0	0.0	0.0	21.4	35.7	42.9	4.21	13	
Developing organization structure	0.0	0.0	0.0	0.0	28.6	21.4	50.0	4.21	14	
Mean								4.42		
<b>Organising:</b>										
Delegating	7.1	0.0	0.0	7.1	21.4	14.3	50.0	3.86	18	
Developing organization structure	0.0	7.1	0.0	7.1	21.4	21.4	42.9	3.79	19	
Establishing relationships	7.1	7.1	0.0	7.1	14.3	28.6	35.7	3.50	20	
Mean								3.72		
<b>Leading:</b>										
Communicating	0.0	0.0	0.0	7.1	7.1	21.4	64.3	4.43	6	
Decision-making	0.0	0.0	0.0	7.1	7.1	28.6	57.1	4.36	8	
Developing people	0.0	0.0	0.0	7.1	21.4	28.6	42.9	4.07	15	
Motivating	0.0	7.1	0.0	7.1	7.1	28.6	50.0	4.00	16	
Selecting people	0.0	0.0	0.0	7.1	14.3	57.1	21.4	3.93	17	
Mean								3.96		
<b>Controlling:</b>										
Correcting performance	0.0	0.0	0.0	7.1	0.0	28.6	64.3	4.50	3	
Performance measuring	0.0	0.0	0.0	7.1	7.1	21.4	64.3	4.43	7	
Developing performance standards	0.0	0.0	0.0	7.1	7.1	28.6	57.1	4.36	9	
Evaluating performance	0.0	0.0	0.0	7.1	7.1	28.6	57.1	4.36	10	
Mean								4.09		
<b>Coordinating</b>	0.0	0.0	0.0	8.3	8.3	8.3	75.0	4.50	4	

Table 4 indicates the extent to which the Candy training contributed to an improvement in understanding and appreciation of nine project parameters. It is notable that all the parameters have MSs  $> 2.50$ , which indicates that the extent of the contribution is major than minor. However, only 3 / 9 (33.3%) parameters have MSs  $> 4.17 \leq 5.00$ , namely cost, time, and

productivity, which indicates that the extent of the contribution is between near major to major / major. These findings were not unexpected. Thereafter, 4 / 9 (44.4%) MSs  $> 3.33 \leq 4.17$ , namely client satisfaction, customer satisfaction, developmental objectives, and quality, which indicates that the extent of the contribution is between a contribution to a near major / near major contribution. Health and Safety, and environment have MSs  $> 2.50 \leq 3.33$ , which indicates that the contribution is between near minor contribution to a contribution / contribution.

Table 4. Extent to which the Candy training contributed to an improvement in understanding and appreciation of the various project parameters.

Parameter	Response (%)							MS	Rank
	U	Did not	Minor .....Major						
			1	2	3	4	5		
Cost	0.0	0.0	0.0	0.0	0.0	13.3	86.7	4.87	1
Time	0.0	0.0	0.0	7.1	7.1	21.4	64.3	4.43	2
Productivity	0.0	0.0	0.0	6.7	6.7	46.7	40.0	4.20	3
Client satisfaction	0.0	6.7	0.0	6.7	6.7	40.0	40.0	3.93	4
Customer satisfaction	0.0	6.7	0.0	6.7	13.3	40.0	33.3	3.80	5
Developmental objectives	0.0	6.7	0.0	6.7	13.3	40.0	33.3	3.80	6
Quality	6.7	6.7	0.0	6.7	6.7	46.7	26.7	3.53	7
Health and Safety	6.7	6.7	0.0	13.3	20.0	40.0	13.3	3.13	8
Environment	13.3	6.7	0.0	6.7	26.7	33.3	13.3	2.93	9

## 5 CONCLUSIONS AND RECOMMENDATIONS

Based upon the findings it can be concluded that the two-day certificate CCS Candy course had an impact in terms of enhancement of both knowledge and skills, and an understanding and appreciation of the practice of construction management in general, and more specifically the functions and activities of management work, and the project parameters, in addition to the planning function and time as a parameter. Although CCS Candy constitutes applications' software, using it requires the use of a range of knowledge areas, and skills, and prompts the users in terms of considering the range of project parameters other than time. Furthermore, the students understand and appreciate the importance and role of the CCS Candy course. Then, it is important to assess the impact of training interventions, regardless of their nature. It is recommended that the two-day certificate CCS Candy course continue to be included as an 'add-on' course, and that the research reported on be conducted on an annual basis.

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