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Abstract	<p>There has been wide recognition that today's graduates need the type of generic capabilities necessary for lifelong learning. However, the mechanism by which universities can develop these generic skills is not clearly established. This study aimed to investigate the mechanism for their development. Structural equation modeling (SEM) was used to test a hypothesized model of capability development through a suitable learning environment with 1756 undergraduates at a university in Hong Kong. To triangulate against this model and more fully characterize the learning environment, focus group interviews were held with five to six students from three programs with good records of capability development. Analysis of the interview data resulted in a set of categories, describing a learning environment, which were consistent with the SEM model. The learning environment which seemed conducive to capability development aimed for understanding of key concepts through a variety of assessment methods and active engagement in learning activities. Teacher-student relationships were developed through interaction, feedback and assistance. The promotion of peer-student relationships led to a high degree of collaborative learning.</p>	
Keywords	active learning - assessment - collaborative learning - generic capabilities - learning environments - qualitative & quantitative analyses - teacher-student relationship	
Footnote Information		

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CHARACTERIZING LEARNING ENVIRONMENTS CAPABLE OF NURTURING GENERIC CAPABILITIES IN HIGHER EDUCATION

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There has been wide recognition that today's graduates need the type of generic capabilities necessary for lifelong learning. However, the mechanism by which universities can develop these generic skills is not clearly established. This study aimed to investigate the mechanism for their development. Structural equation modeling (SEM) was used to test a hypothesized model of capability development through a suitable learning environment with 1756 undergraduates at a university in Hong Kong. To triangulate against this model and more fully characterize the learning environment, focus group interviews were held with five to six students from three programs with good records of capability development. Analysis of the interview data resulted in a set of categories, describing a learning environment, which were consistent with the SEM model. The learning environment which seemed conducive to capability development aimed for understanding of key concepts through a variety of assessment methods and active engagement in learning activities. Teacher-student relationships were developed through interaction, feedback and assistance. The promotion of peer-student relationships led to a high degree of collaborative learning.

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KEY WORDS: active learning; assessment; collaborative learning; generic capabilities; learning environments; qualitative & quantitative analyses; teacher-student relationship.

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INTRODUCTION

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The Hong Kong government has recognized that its education sector needs to produce graduates equipped for lifelong learning if it is to make the necessary transition into a knowledge-based economy. The Hong Kong Education Commission's (1999) consultative document,

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38 “Learning for Life,” believed that the Special Administrative Region
39 needed to embrace the era of lifelong learning.

40 Society is undergoing fundamental changes. As it transforms from an industrial
41 society into an information society, and as our economy shifts its emphasis from
42 manufacturing to knowledge-based activities, knowledge has become an essential
43 element of our daily lives and our economy. Knowledge is being created all the
44 time. New knowledge continues to emerge as existing knowledge becomes
45 obsolete. Learning is no longer confined to school subjects or limited to class-
46 rooms; learning is no longer the prerogative of those aged 622. The age of lifelong
47 learning has dawned. (p. 15)

48 Many other places have recognized similar needs (Aulich, 1990;
49 Australian Chamber of Commerce and Industry & Business Council of
50 Australia, 2002; Confederation of British Industry, 2000; Conference
51 Board of Canada, 2000; Daly, 1994; Longworth and Davies, 1996;
52 O’Neil, Allred, and Baker, 1997). More developed countries have found
53 that their manufacturing industries have had difficulty competing with
54 those in countries with cheaper labor forces. Economic progress then
55 becomes dependent upon progressing towards a knowledge-based soci-
56 ety, which requires a workforce with the types of capabilities needed for
57 lifelong learning. To move in this direction there has been a major
58 expansion in the numbers entering higher education and universities
59 have been exhorted to produce graduates with lifelong learning capabili-
60 ties (Candy and Crebert, 1991; Leckey and McGuigan, 1997; Long-
61 worth and Davies, 1996; Tait and Godfrey, 1999).

62 There are indications that higher education has not been meeting
63 expectations from governments, employers or students in producing
64 graduates well equipped for lifelong learning. Daly (1994) reviewed 20
65 major reports emanating from, or on behalf of, organizations represent-
66 ing the business sector in the US. The over-riding concern was a decline
67 in the competitive edge in the global economy. There was concern that
68 the education system was not producing a suitable workforce to main-
69 tain the position of the US as the leading economic power. A review by
70 Johnstone (1994) also reached similar conclusions by noting that “evid-
71 ence continues to accumulate that our schools are not preparing
72 students to be effective citizens of the world” (p. 170).

73 A number of governments with relatively unified higher education
74 systems, e.g. Australia, Germany, New Zealand, Spain, Switzerland and
75 the United Kingdom, have produced reports and plans calling for grad-
76 uates to be equipped with appropriate higher-order thinking skills (for a
77 review, see Longworth and Davies (1996)) and generic capabilities for
78 employment (Australian Chamber of Commerce and Industry & Busi-
79 ness Council of Australia, 2002; Confederation of British Industry,

80 2000; Conference Board of Canada, 2000). Such calls obviously imply
81 that universities might do better in this respect.

82 Leckey and McGuigan (1997) surveyed academic staff and students in
83 a UK university about the importance ascribed to personal transferable
84 skills. Staff and students thought them equally important but there was
85 a mis-match concerning the effectiveness of their development. The staff
86 thought they were effective in developing them but students thought
87 they were ineffective. This conclusion is consistent with Barrie (2004)
88 who noted that “despite extensive funding in some quarters, overall,
89 efforts to foster the development of generic attributes appear to have
90 met with limited success” (p. 261).

91 The Mechanism of Capability Development

92 The fundamental question then arises as to how higher education can
93 develop graduates with these competencies for lifelong learning? There
94 are descriptions of discrete courses focusing on the nurturing of specific
95 generic skills (e.g. Chapman, 1999; Medlin, Graves, and McGowan,
96 2003; Oliver and McLoughlin, 2001; Tait and Godfrey, 1999). The more
97 common approach has been through the belief that the development of
98 lifelong learning capabilities should be embedded within the learning
99 about the discipline, particularly for the higher-order thinking capabili-
100 ties (de la Harpe, Radloff, and Wyber, 2000; Hattie, Biggs, and Purdie,
101 1996; Jackson, 2000). With crowded curricula it would be hard to find
102 room for specific courses for the necessary range of generic skills. There
103 is also evidence, from the meta-analysis by Hattie et al., (1996) that gen-
104 eric learning skills courses are not very effective, particularly for univer-
105 sity and adult students.

106 While there may be a widespread belief that generic competencies can
107 develop through discipline-specific teaching, there is little evidence of the
108 effective mechanism. In their comprehensive review on the effects of col-
109 lege education, Pascarella and Terenzini (1991) found evidence of intel-
110 lectual qualities being developed during a college education, but the
111 mechanism was unclear.

112 The research on the net effects of college sheds little light on why college atten-
113 dance fosters greater average growth in general cognitive skills than other post-
114 high school experiences. (Pascarella and Terenzini, 1991, p. 156)

115 We interpret this finding from a very extensive and thorough review
116 of the literature on the effects of college on students to imply that there
117 is no empirically established model of how universities nurture lifelong
118 learning capabilities. This would concur with the evidence given above

119 of concerns that university graduates are often ill-equipped for lifelong
120 learning. Given the concern of governments that graduates do possess
121 the capabilities needed for lifelong learning it would appear important
122 that attempts are made to develop appropriate theoretical models indi-
123 cating important variables which impact upon capability development
124 and suggesting the mechanism by which they do so.

125 While the literature on factors affecting the development of generic
126 capabilities is limited, there has been a considerable volume of research
127 on classroom-related learning environments and their effect on student
128 learning outcomes. This body of literature has emanated from several
129 lines of study.

130 First, the literature on the evaluation of teaching attempted to identi-
131 fy the characteristics of good teaching. The review of this work by
132 Marsh (1987) makes it clear that good teaching is a multi-dimensional
133 construct. In designing evaluation instruments it is, therefore, necessary
134 to identify which factors characterize good teaching, which promotes
135 student learning. The list of factors developed by Feldman (1976, 1996)
136 appears to have been the most influential.

137 Students' approaches to learning have been shown to be influenced by
138 the students' perceptions of the prevailing teaching and learning envi-
139 ronment (Ramsden, 1987). There is then a substantial literature on the
140 types of context which promote a deep approach to learning, which can
141 conveniently be accessed through reviews by Biggs (1999a), Marton,
142 Hounsell and Entwistle (1984) and Prosser and Trigwell (1999). Biggs
143 (1999b, p. 73) drew upon the literature to identify the following four
144 factors as likely to encourage a deep approach: a well structured knowl-
145 edge base; an appropriate motivational context; learner activity; and
146 interaction with others.

147 The study reported in this article was associated with a quality assur-
148 ance initiative, which meant that the teaching and learning environment
149 was characterized as far as possible by observable teaching behaviors.
150 This stance was also desirable in that the study was policy-relevant in
151 that it would give guidance to teachers in how to configure their teach-
152 ing so as to best encourage the development of generic capabilities. The
153 characterization of the teaching and learning environment, therefore,
154 eschewed internal-to-the student mechanisms of learning such as self-
155 regulated learning (e.g. Pintrich, 1995) and constructs developed from
156 the social-cognitive mediation model of student learning (e.g. Pintrich
157 and Zusho, 2002).

158 This article is from a series of studies which have progressively aimed
159 to build up a theoretical model of capability development and test it
160 with empirical data (Kember and Leung, 2005a, b; Kember et al., 2001;

161 Leung and Kember, 2005). Kember and Leung (2005a) used structural
162 equation modeling (SEM) to show that the principal effect on capability
163 development came from teaching which aimed for understanding and
164 required active involvement from students. The data came from a survey
165 which asked graduates of a university in Hong Kong for their perception
166 of the development of nine capabilities during the course of
167 their program of study. The survey also asked for their ratings of a limited
168 range of factors concerned with teaching and learning.

169 Kember and Leung (2005b) used the same survey technique with a
170 sample of undergraduate students at another university in Hong
171 Kong. The survey included a broader range of variables relating to
172 the teaching and learning environment. The teaching and learning
173 environment was described by three latent variables with a total of
174 nine indicators. The three latent variables were shown to have a significant
175 effect on students' perceptions of the development of six generic
176 capabilities.

177 The study by Kember and Leung (2005b) concentrated on SEM
178 analysis of the quantitative data and provided a detailed explanation
179 of the SEM procedures. This article reports an extension of the same
180 study which goes further towards characterizing the types of teaching
181 and learning environment which play a part in nurturing capabilities
182 by reporting both a SEM model of capability development and a
183 qualitative study of three programs found to have teaching and learning
184 environments most effective in developing capabilities for lifelong
185 learning.

186 Fraser (1998, p. 3) gives a definition of a learning environment.

187 'Learning environment' refers to the social, psychological and pedagogical
188 contexts in which learning occurs and which affect student achievement and attitudes.

189 The concept is, therefore, a broad one. Learning environment refers
190 to the teaching and learning in- and out-of-class and to the contextual
191 factors which influence the way that learning is approached. It resembles
192 the holistic sense of the term "curriculum," as it is used in the
193 school sector (e.g. Brady, 1990; Kelly, 1999).

194 QUANTITATIVE STUDY AND FINDINGS

195 Data for the quantitative part of the study were gathered through a
196 survey of undergraduate students at a university in Hong Kong. The
197 survey examined perceptions of capability development and ratings of
198 factors in the teaching and learning environment.

199 Development of the Instrument

200 The capabilities most relevant to the ability to engage in lifelong
201 learning were selected by panels of academics from each faculty of a
202 university in Hong Kong. Each panel was asked to describe the capabil-
203 ities needed by graduates in their discipline area to function as a lifelong
204 learner. The outcomes from the panels were then compared and a syn-
205 thesis made of the most common capabilities and those indicated as
206 most important (Leung and Kember, 2005). Testing of the questionnaire
207 with graduates from a university in Hong Kong led to several iterations,
208 after which the questionnaire consisted of nine scales measuring gradu-
209 ate capabilities (Kember and Leung, 2005a).

210 To make the questionnaire more applicable to undergraduate stu-
211 dents, who were the target population of the current study, three scales
212 about the desirable capabilities of graduates were deleted and one scale
213 was reworded. As a result of this exercise the questionnaire included
214 scales for the following capabilities needed for lifelong learning (Kember
215 and Leung, 2005b):

- 216 • *Critical thinking*
- 217 • *Self-managed learning*
- 218 • *Adaptability*
- 219 • *Problem solving*
- 220 • *Communication skills*
- 221 • *Interpersonal skills and groupwork*

222 Throughout this article we adopt the convention of showing scale
223 names in italics. The titles for latent variables in structural models are
224 shown bolded.

225 The scales used to describe the teaching and learning environment
226 were also developed over the series of studies. The original instrument
227 had more scales focusing on the student experience (Leung and Kember,
228 2005). As it was found that the teaching and learning environment had
229 a greater than expected impact on the development of capabilities, the
230 instrument used in Kember and Leung (2005a) placed more emphasis
231 on teaching and learning. Factors found to have significant relationships
232 to perceptions of capability development in these previous studies were
233 retained and similar constructs added.

234 The following scales were used to describe the teaching and learning
235 environment (Kember and Leung, 2005b).

NURTURING GENERIC CAPABILITIES

- 236 • Active learning
- 237 • Teaching for understanding
- 238 • Assessment
- 239 • Coherence of curriculum
- 240 • Teacher–student interaction
- 241 • Feedback to assist learning
- 242 • Assistance from teaching staff
- 243 • Relationship with other students
- 244 • Cooperative learning

245 All items were scored on a 5-point Likert scale ranging from 1 =
246 ‘strongly disagree’ to 5 = ‘strongly agree’. Appendix 1 displays the
247 questionnaire with 33 items measuring the development of the six capa-
248 bilities and the nine elements in the teaching and learning environment.
249 The nature of the items should help readers understand the constructs
250 measured by the scales. The questionnaire had other scales which are
251 not shown in Appendix 1 as they were not incorporated in the model
252 tested in this article.

253 Sample and Procedures

254 The questionnaire was administrated to a total sample of 2,786 year 1
255 and year 3 undergraduate students from a university in Hong Kong.
256 The sample consisted of all students in half of the 50 undergraduate de-
257 gree programs offered by the university. The programs selected were a
258 structured sample representative of undergraduate degrees offered by the
259 comprehensive university. There were, therefore, programs from each of
260 the seven faculties; Arts, Business Administration, Education, Engineer-
261 ing, Medicine, Science and Social Science.

262 A 63.9% response rate resulted in questionnaires being received from
263 1,779 students (year 1, $n = 1028$; year 3, $n = 751$). Deletion of 23 cases
264 with missing data ultimately yielded a final sample of size 1756, 63.0%
265 of the total sample. A breakdown of the return rate by year of study
266 and faculty are shown in Table 1.

267 Scale Reliability

268 Before testing the structural relationship among the 15 scales in the
269 study, their reliabilities were established with Cronbach- α . Mean,
270 standard deviations, and α values of the 15 scales were computed
271 with SPSS11.5 (Norusis, 2002) and are shown in Table 2. Schmitt
272 (1996) discussed the value of α which should be acceptable and noted

TABLE 1. Return Rates by Year of Study and Faculty in the Study

Faculty	Year 1 (%)	Year 3 (%)
Arts	74.9	63.3
Business Administration	68.4	54.2
Education	44.0	61.1
Engineering	60.9	51.0
Medicine	82.2	58.2
Science	68.4	60.7
Social Science	71.8	56.3
Overall	69.8	57.2

273 that a number of sources recommended the .7 level, but argued that
 274 values as low as .5 would not seriously attenuate validity. The scales
 275 were kept as short as possible to boost returns and this would have
 276 tended to reduce α values (Schmitt, 1996). Of the scales in the instrument
 277 10 had Cronbach α values above .7 and the remaining 5 were
 278 between .54 and .7.

TABLE 2. Mean, Standard Deviations, and Cronbach α Values of the 15 Scales in the Study

Scale	Mean	St. Dev.	α
<i>Teaching & Learning Environment</i>			
Active learning	2.94	.90	.69
Teaching for understanding	3.65	.78	.79
Feedback to assist learning	3.46	.78	.80
Assessment	3.48	.78	.58
Teacher-student interaction	3.35	.93	.88
Assistance from teaching staff	3.50	.82	.84
Relationship with other students	2.96	1.08	.86
Cooperative learning	3.44	.87	.71
Coherence of curriculum	3.31	.84	.79
<i>Capability</i>			
Critical thinking	3.44	.89	.78
Self-managed learning	4.00	.71	.72
Adaptability	3.86	.67	.60
Problem solving	3.71	.68	.67
Communication skills	3.33	.96	.72
Interpersonal skills & groupwork	3.37	.85	.54

279 **Structural Analysis**

280 SEM was used to test a model for the development of capabilities
281 through the teaching and learning environment. The hypothesized model
282 was based on previous work (Kember and Leung, 2005a, b; Leung
283 and Kember, 2005). The model, with error terms of the scales and
284 disturbance terms of the latent variables omitted for simplicity, is shown
285 in Fig. 1.

286 The capabilities are grouped under two higher order latent variables.
287 The **Intellectual** latent variable groups four capabilities concerned with
288 higher-order thinking skills. The **Working together** latent variable sub-
289 sumes *communication* and *inter-personal* capabilities. The teaching and
290 learning environment is characterized by nine variables structured under
291 three latent variables labeled; **Teaching** which is characterized by four
292 scales *active learning*, *teaching for understanding*, *assessment* and *coher-*
293 *ence of curriculum*; **Teacher–student relationship** which had three scales
294 *teacher–student interaction*, *feedback to assist learning*, and *assistance*
295 *from teaching staff*; and **Student–student relationship** subsumes *relation-*
296 *ship with other students* and *cooperative learning* scales. The latent vari-
297 ables on each side of the model were hypothesized to be co-related. It
298 was also hypothesized that there would be paths between the teaching
299 and learning environment side of the model and the capability half,
300 though the exact nature of these paths was left open for SEM testing.

301 The EQS package (Bentler, 1995) was used for the SEM analysis.
302 Assessment of model fit was based on multiple criteria including both
303 absolute misfit and relative fit indices. The absolute misfit indices
304 included the Root Mean Square Error of Approximation (RMSEA;
305 Browne and Cudeck, 1993) and the standardized root mean squared
306 residual (SRMR; Bentler, 1995). The relative goodness-of-fit index com-
307 puted in the study was the Comparative Fit Index (CFI; Bentler, 1990).
308 According to Hu and Bentler's (1999) simulation study, judgment of
309 model fit based on a two-index strategy which includes SRMR less than
310 .08 and a supplemental index with a given cutoff criteria is superior to
311 those only based on a single criterion. In this study, a model with
312 $SRMR < .08$, $RMSEA < .06$ and $CFI > .95$ would be considered as
313 an excellent fit to the data.

314 **Results of Structural Analysis**

315 The goodness-of-fit and misfit indices obtained for the final model
316 were $SRMR = .04$, $RMSEA = .06$, and $CFI = .92$ which yielded a
317 reasonably good approximation to the data. The model hypothesized

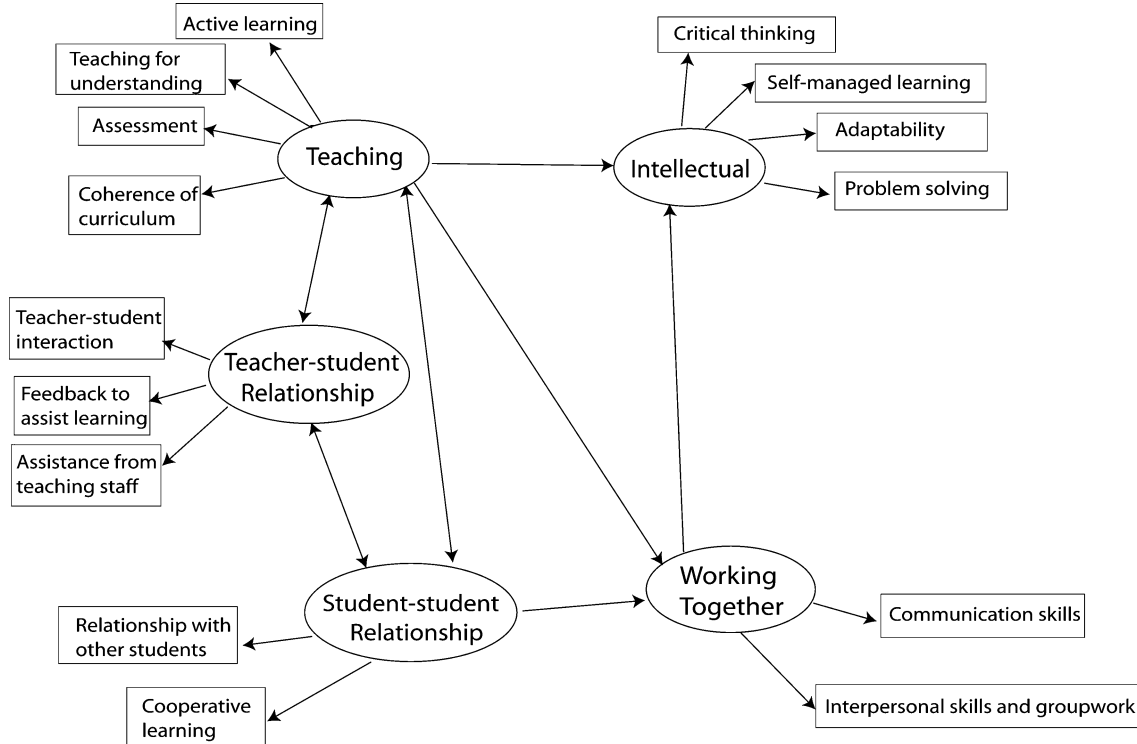


FIG. 1. The hypothesized model relating the teaching and learning environment to capability development. *Keys:* Latent variables are in ovals and observed variables are in rectangles.

318 that the capabilities can be nurtured through an appropriate teaching
319 and learning environment, which is described in the model by nine indi-
320 cators grouped under three higher order factors. The standardized coef-
321 ficients indicate that the strongest effect on capability development came
322 from the nature of the teaching. **Teaching** had direct influences on both
323 capability latent variables and a significant indirect effect on **Intellectual**
324 through **Working Together** (standardized coefficient = .11, $p < .001$).
325 Combining both the direct and indirect effects, **Teaching** impacted
326 strongly on **Intellectual** capabilities (standardized total effect = .43) and
327 the qualities needed for **Working Together** (standardized total
328 effect = .29). The tested version of the model, with the standardized
329 coefficients, is shown in Fig. 2.

330 The SEM model hypothesized that a teaching and learning environ-
331 ment can play a role in the development of the capabilities needed for
332 lifelong learning. The model had a good fit to the data. Students per-
333 ceptions of a high quality in elements in the teaching and learning envi-
334 ronment tended to coincide with perceptions of the nurturing of the
335 selected capabilities.

336 USE OF QUALITATIVE DATA TO AMPLIFY THE MODEL

337 While the SEM model provides a succinct definition of a suitable
338 environment for nurturing lifelong learning capabilities, we felt that it
339 would be helpful to teachers and curriculum designers to have a more
340 detailed and richer description of such an environment. This could be
341 provided through complementary qualitative data. Obtaining comple-
342 mentary qualitative data could also help in strengthening the conclu-
343 sions by triangulation between the two data forms.

344 The quantitative data had been gathered in a quality assurance pro-
345 ject, which aimed to give feedback to departments on the programs they
346 offered. The data were reported to departments as profiles showing
347 mean scores on each scale, together with z-scores which compared
348 results to those of the other programs. There were also qualitative com-
349 ments obtained as responses to two open-ended questions.

350 It was, therefore, possible to identify programs which were more suc-
351 cessful at developing capabilities for lifelong learning. Accordingly three
352 programs were selected which had above average scores for perceptions
353 of capability development on each of the capability scales. Focus group
354 interviews were then arranged with five or six representative students
355 from the three programs. The students were generally from the latter
356 years of the programs, so that they could comment upon most of the

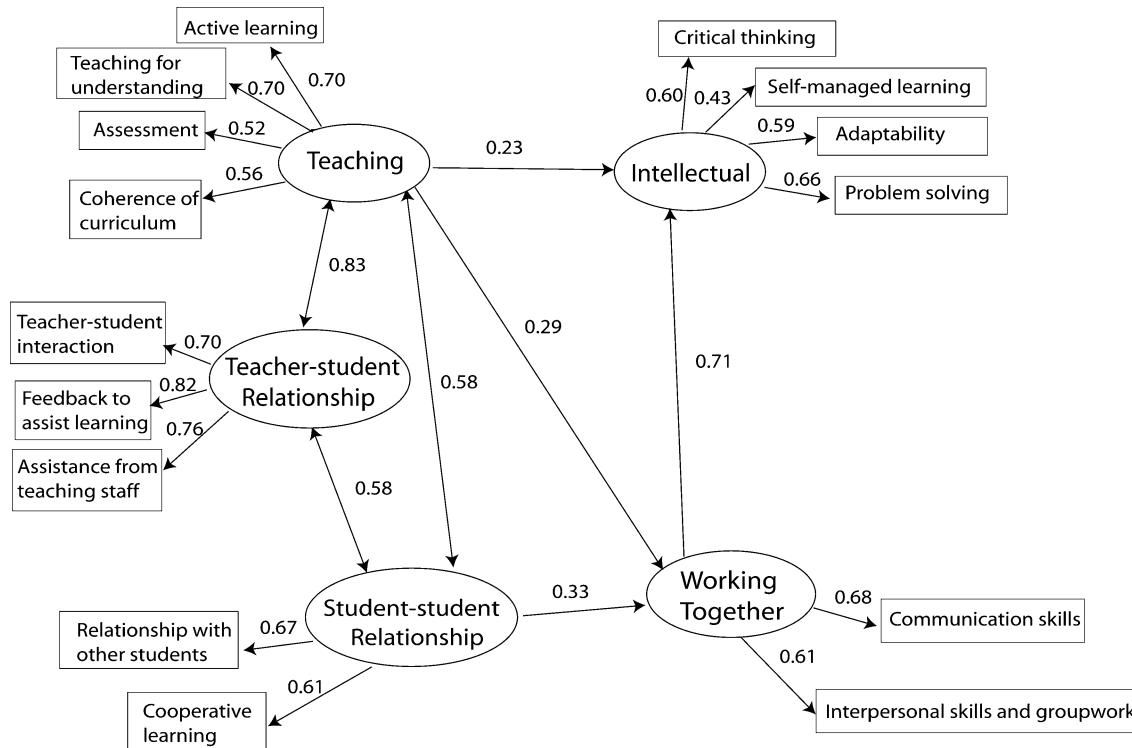


FIG. 2. Standardized parameter estimates of the structural model relating the teaching and learning environment to the development of capabilities. *Keys:* Latent variables are in ovals and observed variables are in rectangles.

357 program. The students would have previously completed the question-
358 naire survey.

359 The interviews had an open format. Semi structured questions asked
360 the students to describe the approach to teaching, the assessment and
361 the curriculum. Prompts were used to seek greater depth and richer
362 descriptions where necessary. The three interviews each lasted for
363 approximately 90 minutes.

364 Illumination of Variables in the Teaching and Learning Environment

365 The aim of the analysis was to synthesize a composite picture of good
366 teaching practice which included common aspects across the three pro-
367 grams. The teaching in the programs was not perfect; so the students
368 noted a range in teaching quality between teachers and courses. The
369 analysis concentrated on interview comments which were seen as
370 descriptions of the best practice; so that it was possible to describe a
371 composite picture of the type of teaching and learning environment
372 most capable of nurturing the type of capabilities needed for lifelong
373 learning.

374 The analysis started with an open inductive stance which sorted the
375 interview comments into categories referring to aspects of teaching and
376 learning such as assessment or the relationship between teachers and
377 students. The categories which emerged were then compared to the ele-
378 ments of the teaching and learning environment in the SEM model.
379 There was a reasonably strong overlap between the qualitative catego-
380 ries and the quantitative scales. Evidence for the veracity of this asser-
381 tion can be found in the following parts of this section in which
382 extensive quotations from the interviews can be seen to fit comfortably
383 under headings or category labels corresponding to the scales in the
384 SEM model.

385 The trustworthiness of the conclusions was established by triangula-
386 tion (Miles and Huberman, 1994). As five or six students were
387 included in each focus group it was possible to examine the consis-
388 tency between the comments of individuals. The sense of all of the
389 quotations included was verified against the comments of at least one
390 other member of the focus group. An extra dimension of triangula-
391 tion was provided by fitting the qualitative data against the quantita-
392 tive model.

393 In this section, the interview data are used to amplify the meaning of
394 each of the nine elements of the teaching and learning environment and
395 to verify the model shown in Fig. 1 as a model for the development of
396 capabilities. Essentially the qualitative data is used to provide a rich

397 description of the teaching and learning environment. Sufficient detail
398 about the three programs can be derived from the quotations to see
399 how the programs operate and see how they function to nurture capa-
400 bilities. Presenting the data in this way provides powerful substantiation
401 for the model through triangulation between the quantitative and the
402 qualitative analyses.

403 It is noteworthy that there is a degree of overlap within the quota-
404 tions with respect to the aspects of the teaching and learning environ-
405 ment to which they apply. This is consistent with the hierarchical nature
406 of both halves of the model. Each element of the teaching and learning
407 environment is subsumed under three higher-order latent variables.
408 Finding a degree of overlap in quotations is, therefore, consistent with
409 the model.

410 The three focus groups were from programs in Architecture, Govern-
411 ment and Public Administration and Nursing. At the end of the quota-
412 tions which follow the student's program is identified by the letters A,
413 G and N respectively. Each student was given a numerical code in addi-
414 tion.

415 The first four variables are grouped under the **Teaching** latent vari-
416 able and describe the nature of the teaching approach, the assessment
417 and the curriculum. The **Teaching** latent variable, and its four constit-
418 uent indicators, impacted directly on the development of capabilities
419 grouped under both the **Intellectual** and **Working together** latent vari-
420 ables.

421 *Active Learning*

422 An important characteristic of the teaching approach was the degree
423 of interaction between teachers and students. There were activities
424 which prompted discussion in class.

425 In our program, we have a lot of tutorials and small group discussion. We
426 have lively interaction with professors. We are engaged in forming and voicing
427 our views and the professor will duly respond to us. They would choose topics
428 which are rather unusual that would shock your system and make you really
429 think. They would have prepared a lot of questions that stimulate our thinking
430 and students are actively engaged in thinking and generating their opinions/
431 answers. (G2)

432 These interactions gave the students practice in critical discussion
433 which helped in the development of critical thinking and other higher
434 order thinking capabilities. The importance of providing practice in the
435 deployment of the capability in learning activities is also illustrated in
436 the next quotation. This time the capability in question is self-managed

NURTURING GENERIC CAPABILITIES

437 learning. In the Nursing course the students were not presented with a
438 complete set of content; so they had to practice the management of
439 their own learning by finding some material themselves.

440 For instance, sometimes the notes given do not contain all the information, then
441 we will look up from the references for details of the situation, what is happening
442 and the current thinking abroad. (N1)

443 *Teaching for Understanding*

444 To stimulate the capabilities linked under the **Intellectual** latent variable
445 (critical thinking, self-managed learning, adaptability and problem
446 solving) it was necessary for the teaching to focus on depth and understanding
447 of key concepts. The higher order thinking skills develop
448 through their application during the program of study.

449 The good teachers give real life examples, the presentation is informal and yet full
450 of intellectual reflections. They show you how to go in depth into analyzing an
451 issue rather than just touching the surface. (G3)

452 The teachers, therefore, needed to refrain from being too didactic or
453 directive. Instead students needed prompting and encouragement to
454 explore issues themselves.

455 They won't give you a ready-made answer and they expect you to further explore
456 the topic yourself. They use questions to stimulate you to think deeper into the
457 issue or answers. From the point of view of study, some students might prefer
458 teachers to give them a straight answer. (N4)

459 *Assessment*

460 Assessment is important as it has a strong influence on the learning
461 approach students adopt (Biggs, 1999a; Thomas and Bain, 1984). To
462 encourage the development of lifelong learning capabilities it is, therefore,
463 necessary to have a variety of forms of assessment which require
464 the deployment of the desired capabilities. The three quotations below
465 show the variety of forms of assessment used in the Nursing courses.
466 There is also an indication that the students can see how the types of
467 assessment are relevant to the capabilities they will need in their future
468 practice.

469 We have a variety of assessment methods, such as term paper, final exams, oral
470 exams, clinical skills exams in class and in hospital, writing of care plans. We are
471 also assessed continuously on our mannerism and behavior, things like if we are
472 polite to the patient, if we are punctual and our language, if we live up to our
473 professional integrity and conduct. (N4)

474 I can give an example. In one course, it was the first year we were asked to do
475 some posters as part of the assignment. (N3)

476 This care plan was made statutory by the Nursing Council, to assess our ability in
477 diagnosing the patient's needs, setting goals and expected outcomes, then design
478 what interventions are required, then evaluate the effectiveness of our interven-
479 tions. The objective of the day is to do this and write it down on paper for assess-
480 ment by our tutors. (N1)

481 The three programs had a low proportion of the assessment in the
482 form of tests and examinations compared to other undergraduate pro-
483 grams in the university. Much of the assessment for architecture was
484 from their design projects. They also used a variety of forms of assess-
485 ment in other components of the program. The subjective nature of the
486 assessment indicates that it was testing higher-order thinking.

487 We have presentations, case study analysis, essay writing, term paper based on
488 some research. Occasionally, we have quizzes, but not frequently. Other than
489 quizzes, all these assessment methods tend to be a bit subjective. This is under-
490 standable since design is a subjective thing. (A2)

491 The Government and Public Administration program offered flexibil-
492 ity in assessment. The students had some choice in the way they were
493 assessed through their choice of courses. There was also flexibility over
494 choice of topics for assignments. This meant that students could pick a
495 subject they were interested in and examine it in great depth.

496 I am very satisfied with the assessment practice. Based on my combination, I am
497 free to choose to do a term paper and a presentation. I am given the freedom to
498 concentrate and research in-depth into the topic that I've chosen. I like that very
499 much, to be able to do what I am really interested in. The trade off could be that
500 I only know a lot of a very narrow part of the knowledge and not knowing very
501 well other broader issues. (G4)

502 *Coherence of Curriculum*

503 In order to prompt students to seek a deep understanding of key con-
504 cepts in a discipline, it is important that they can see the relationship
505 between topics. Otherwise topics are treated as isolated chunks of infor-
506 mation, which can be forgotten as soon as the course has been com-
507 pleted.

508 Bringing coherence into a curriculum is illustrated by the Architecture
509 program. The department had seen a parallel between coherent curricu-
510 lum design and their own discipline. The program was bound together
511 by the studios. These were integrated with subsidiary subjects. The

512 design had clearly worked, as students had perceived the intended links
513 and structure.

514 Our design studio is a vertical studio. Each year has four sections and each section
515 has a cross-year group which forms different studios. There are a few parts
516 in a studio, and each part is led by a different tutor. (A4)

517 We have to take the major's courses which include studio design, architectural
518 history, building technology. You have to take them in each semester. There are
519 some other electives which you can select. (A5)

520 That was the same for me. Other courses were subsidiary to be integrated into the
521 studio. So I think there is slight change from when we were doing our course.
522 (A2)

523 Other courses such as history, structure, how to use materials are useful knowl-
524 edge being given whereas you are actively creating something in the studio. (A1)

525 *Teacher–student Interaction*

526 The next three sections refer to the three variables subsumed under
527 the **Teacher–student relationship** latent variable. This latent variable does
528 not impact directly upon the development of capabilities, but acts indi-
529 rectly through the other two latent variables on the teaching and learn-
530 ing environment side of the model. Good teacher–student relationships
531 and a high degree of interaction are needed to support the type of
532 teaching described above. Development of close relationships also facili-
533 tates the teaching which requires the students to be actively engaged in
534 discussion. Positive teacher–student relationships also help promote
535 coherence within a class group, which leads to positive peer–student
536 relationships.

537 Each of the focus groups reported high levels of teacher–student
538 interaction. The degree of interaction was consistent with the deploy-
539 ment of teaching approaches requiring active student engagement. The
540 quotation from an Architecture student below shows that it was not just
541 the amount of interaction which was important, but the nature of it.
542 Questioning techniques which required students to delve deeper and be
543 more reflective were more likely to stimulate higher order thinking capa-
544 bilities.

545 Sometimes it feels the more you ask, the more it becomes unclear and lacking
546 direction. From the beginning, based on my own perception of thinking of my
547 design, I feel firm about my idea. Then you go and see them. They will not
548 offer you an alternate idea and tell you that your original one is not good.

549 Rather, they will continuously ask you questions, ‘Do you think this is good
 550 in this way here?’ I recognize that they are trying to make us reflect on our
 551 own work. But when they are posing so many questions, this leads me wonder
 552 if they want me to do it in a different way. It really depends on their ques-
 553 tioning technique. (A4)

554 *Feedback to Assist Learning*

555 The good teachers provided feedback to students on their work. This
 556 could be to the whole class.

557 Feedback to assignments is done in a collective way during lessons. They will tell
 558 us what problems we have in general. For individual feedback, you’ll need to go
 559 and see the course co-ordinator. (N2)

560 It could also be to individuals.

561 Sometimes, if you’ve done a very good piece of work, or otherwise, the professor
 562 will discuss it with you in private. It’s quite flexible and informal. (G2)

563 *Assistance from Teaching Staff*

564 To generate the high levels of interaction the teachers needed to be
 565 available to talk with students.

566 In general, most professors have an open door policy whereby students feel wel-
 567 come to go and see them whenever they need. If students don’t take that opportu-
 568 nity, it is their loss really. Few individual professors might seem to be a bit more
 569 reserved, but according to my own experience, they are very happy and able to
 570 give you guidance whenever you seek their help. (G3)

571 The Architecture course employed a student-centered approach to
 572 teaching, which left students to discover ideas themselves. The teachers
 573 were available to provide support when necessary, though.

574 Even if the teachers do not give much during the lesson, we can ask them directly.
 575 They will give us sufficient time that we can freely go and see them, or we can
 576 send them an email. They will suggest some books or paths for reference. (A5)

577 *Relationship with Other Students*

578 The final two variables are grouped under the **Student–student rela-**
 579 **tionship** latent variable on the teaching and learning environment side of
 580 the model. This two-variable factor impacts directly upon the develop-
 581 ment of the **Working together** capabilities.

NURTURING GENERIC CAPABILITIES

582 Teachers are able to play a part in developing student–student rela-
583 tionships and coherent class groups. One method was through the active
584 learning approaches described above. While engaging in discussion
585 in- and out-of-class the students are provided with an opportunity to
586 get to know each other. Having group activities led to class coherence.

587 We get to know each other quite well in our first year. Our social group is then
588 formed and will remain through the years, whereas, academically, we are con-
589 stantly arranged into different groups for projects, tutorials and clinical practice,
590 and we get to know more students that way. (N4)

591 Architecture prompted good student–student relationships by provid-
592 ing an open studio in which students of all years could discuss their work.

593 Among students we discuss a lot, which is really helpful. We'll look at each oth-
594 er's design and gather more opinions that way. Our studio is open without walls.
595 Students from all years are there. There will be MArch Year 2 students sitting
596 next to me (a second year undergraduate student). They are able to give me ideas.
597 We communicate really well. (A4)

598 *Cooperative Learning*

599 The benefit of good student–student relationships comes through the
600 formation of study groups which try to make sense together of difficult
601 concepts.

602 Occasionally when there are stuff that we don't understand during lectures, we'll
603 ask our friends after class quite naturally. (N3)

604 Stuff that we don't understand, we'll reach an understanding when we revise
605 together. (N1)

606 The students in all three programs worked together out-of-class using
607 an *engager* approach (Yan, 2001; Yan and Kember, 2004a, b), which
608 implies that the collaboration was focused towards members of the
609 group trying to reach a better understanding together. This cooperative
610 learning provided practice in communication and interpersonal skills,
611 which in turn led to their development.

612 Cooperative learning out of class is quite important for me. My academic perfor-
613 mance in Year 1 was quite poor and I was lucky to have a few students who
614 could help me out. We would continue our discussion right after class which
615 helped me a great deal in understanding the subject and consolidating my mem-
616 ory. We also discussed how we would tackle the paper assignments and before
617 exams. This has definitely improved the quality of my learning, much better than
618 if I were to do it on my own, going to the library and dig the book out by the
619 author's name. (G5)

620 CONCLUSION

621 There is wide acceptance of the need for university graduate to be
622 able to display the types of generic competencies needed for lifelong
623 learning. Higher-order intellectual capabilities, such as critical and crea-
624 tive thinking, adaptability, the ability to solve ill-defined problems and
625 the ability to manage one's own learning are seen as important. The
626 ability to work with others is necessary; so communication and interper-
627 sonal skills are vital.

628 While most universities would now claim to be nurturing such capa-
629 bilities in their graduates, few would be able to clearly articulate how
630 this is accomplished and provide evidence to substantiate their claims.
631 This is not surprising as the mechanism by which lifelong learning capa-
632 bilities are nurtured has not been clearly established in the literature.

633 This study attempted to provide some guidance to universities in how
634 to develop lifelong learning capabilities by demonstrating that a particu-
635 lar type of learning environment is conducive to capability development,
636 and then providing a detailed characterization of that environment. The
637 method employed was unusual in that it featured a combination of
638 SEM and qualitative data from focus group interviews.

639 SEM is a powerful statistical technique able to test the type of com-
640 plex multifaceted models which describe real social science and educa-
641 tional phenomena. These invariably involve multiple variables which
642 show a high degree of interaction or influence with each other. In this
643 instance the SEM was able to test a model which incorporated a teach-
644 ing and learning environment defined by nine factors grouped under
645 three higher order factors. A model which hypothesized this environ-
646 ment nurturing six capabilities needed for lifelong learning showed a
647 good fit to the data.

648 The data from the focus group interviews with students from three
649 programs perceived to have good records in nurturing capabilities was
650 consistent with the SEM model. Triangulation between the qualitative
651 data and the SEM analysis strengthens the evidence that the teaching
652 and learning environment can influence students' perceptions of capabil-
653 ity development. The interviews also provide a richer and more detailed
654 description of the teaching and learning environment which had been
655 successful in developing the generic capabilities. In the interviews the
656 students described good practices in teaching and curriculum develop-
657 ment; so provided a characterization of a teaching and learning environ-
658 ment capable of developing lifelong learning capabilities.

659

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664 **APPENDIX 1. STUDENT ENGAGEMENT QUESTIONNAIRE**

665 © 2003 David Kember, Doris Y.P. Leung and Carmel McNaught
666 Please indicate your level of agreement with the statements below.
667 Please choose the one most appropriate response to each question.

- 668 1. strongly disagree
669 2. disagree
670 3. only to be used if a definite answer is not possible
671 4. agree
672 5. strongly agree

Critical Thinking

1. Through this program I have developed my ability to make value judgments about opposite perspectives
2. I have become more willing to consider differing points of view

Self-managed Learning

3. I feel that I can take responsibility for my own learning
4. I have become more confident of my ability to pursue further learning

Adaptability

5. During my time at university I have learned how to be more adaptable
6. I have become more willing to change and accept new ideas

Problem Solving

7. I have improved my ability to use knowledge to solve problems in a systematic way
8. I am able to bring information and ideas together from different topics to solve problems

Communication Skills

9. In this program I have developed my ability to communicate effectively with others
10. In my time at university I have improved my presentation skills

Interpersonal Skills and Groupwork

11. I have learnt how to become an effective team or group member
12. I feel confident that I can deal with a wide range of people

Active Learning

13. Our teaching staff use a variety of teaching methods
14. Students are given the chance to participate in class
-

Teaching for Understanding

15. The teaching staff try hard to make us understand the course material

16. The teaching staff for this program design classes with the aim of the students reaching an understanding of the course content

Feedback to Assist Learning

17. When I had difficulty with assignments, I found the feedback provided by the teaching staff useful

18. There was sufficient feedback on activities and assignments to ensure that we learnt from the work we did

19. When I was unsure about an assignment, the teaching staff helped me to reach an understanding about how to finish it

Assessment

20. The program uses a variety of assessment methods

21. To do well in assessment in this program you need to have good analytical skills

22. For the assessment in this program it is important to have developed self-learning capability

Teacher–student Interaction

23. There is a close relationship between teaching staff and students

24. The communication between teaching staff and students is good

Assistance from Teaching Staff

25. When I had difficulty with the course content, the teaching staff were available to help

26. I found teaching staff helpful when I had problems understanding the course content

Relationship with Other Students

27. I feel a strong sense of belonging to my class group

28. My class groups have developed a strong sense of working together

Cooperative Learning

29. I have frequently discussed ideas from courses with other students out-of-class

30. I have found that discussing course material with other students outside classes has helped me to reach an understanding of the material

Coherence of Curriculum

31. I can see how courses fitted together to make a coherent program of study for my major

32. The program of study for my major was well integrated

33. I could clearly see the relationship between the courses in my major program

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NURTURING GENERIC CAPABILITIES

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