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The assessment of formal management development

A method, a baseline and the need to incorporate learning styles

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Abstract

Purpose – To assess the impact of a course on the development of management competencies for students over the duration of the course, by examining changes in the competencies of the students. The potential impact of student learning styles was also examined in the study.

Design/methodology/approach – A “Pre, Post, Then” design and a combination of paired sample t-tests, and alpha and beta change statistics were used to examine the change in competencies over time.

Findings – This study found that even a standard subject design had a significant and substantial impact on the management competence development of the students.

Practical implications – From the perspective of students-as-products, the base line provided here allows for the testing of alternative designs of educational systems, whereby alternative designs have to prove a benefit above and beyond that of a basic teaching system. Therefore, the present study should assist the field of management development to create a range of design options.

Originality/value – This study applies a powerful and under-utilised research method to provide a base line of the amount of management development that can occur in a typical formal management course, but is unique in that it includes the impact of the students’ learning styles.

Managers around the world face a competitive, rapidly changing work environment and need to be competent by international standards. To succeed in this changing environment it has been suggested that a more general education for managers is needed (BCG, 1995) so that training is not “narrowly focused only on the technical needs of the job” (Midgley, 1995, p. 1400), and develops “skills in general and strategic management” (Midgley 1995, p. 1408). The development of management skills, abilities and knowledge in a formal environment typically occurs at university, either at undergraduate or postgraduate level. The students of these management programs represent a key avenue of management development.

From a complementary perspective, research has suggested that academics should acknowledge that the two key views of students are as:

1. customers of educational services; and
2. products – the key results of transformation activities (Lengnick-Hall and Sanders, 1997).
Indeed, the investigation of changes in students would increase our understanding of the relationships between course design and student-as-product results (Lengnick-Hall and Sanders, 1997).

“In education, learning and students’ improved knowledge and skills are the primary deliverables” (Lengnick-Hall and Sanders, 1997, p. 1342). Customer satisfaction, as measured by student reactions to a course and its design, are key outcomes to evaluate. However, viewing students only as a conventional customer creates two problems (Lengnick-Hall and Sanders, 1997). First, it neglects the potentially competing preferences of other important customer groups such as government, employers, students’ families and the public (Karpin, 1995). Second, the conventional view of students as customers neglects their key role as the primary deliverable, or product, of the learning system (Sirvanci, 1996).

Lengnick-Hall and Sanders (1997) conclude their study with several useful avenues for future research. Among them is a call for the investigation of courses with different design premises to their “high-involvement” structure. Second, they call for research methods that track actual performance before and after completing a course. To address these issues the students in a “typical” introductory undergraduate management course are examined to explore the degree of change enacted on the students-as-products.

High-involvement or alternate subject designs, such as the four designs in Bigelow et al. (1999) or the now-modified PROBE (Shaw and Fisher, 1999), can then be assessed relative to this baseline and thereby the differential impact of those alternative designs can be examined. Subsequently, the text below first briefly reviews the use of competence development as a performance indicator and then goes into more detail about learning styles.

To assess the impact of the course on the student, in terms of management development, the change in management competencies of the students is examined, including the potential impact of student learning styles. A full comparison study has very recently been provided by Shaw et al. (1999), wherein a sophisticated design is compared to a proposed baseline, albeit a baseline from a different context. Notable by its absence in Shaw et al. (1999) is any comprehensive inclusion of learning styles, based on any of the more widely accepted learning models (e.g. Kolb, 1984). This study seeks to detail the impact of a typical lecture and tutorial design subject, thereby clarifying and testing some of the findings of Shaw et al. (1999), and also seeks to examine the impact of learning styles within this standard context. Indeed, the “effectiveness of any learning process” is largely determined by learning styles (Mumford, 1987, p. 53) and therefore it is with a stronger and more comprehensive emphasis on learning styles that this paper seeks to further the leading work of Shaw et al. (1999). By examining the impact of learning styles for a standard course, on the students’ acquisition of competencies a baseline will have been established for the treatment of students-as-products in this key area of management development.

The assessment of management development outcomes for students

Within an educational context a key indicator of outcomes from a course would be the development of the student. Prior research on outcome assessment has examined the students’ development of skills, abilities and knowledge (Bovatzis, 1982). Similarly, reviews of business and management education such as the Business Higher Education Forum (1985) report in the USA and the Karpin (1995) report in Australia have concluded that management education needs to focus more explicitly on the development of students’ competencies.
Studies examining the competencies of management include Burgoyne and Stuart (1976), McCall et al. (1988) and Whetten and Cameron (1995), among others. The main findings in the literature have several elements in common: strategic thinking, problem solving, decision making, team skills, communication and leadership (Dickenson et al., 1995).

The development of these competencies, as indicators of a student's knowledge, skills and abilities, represents the characteristics of the student-as-product. Further, using the customer metaphor of Lengnick-Hall and Sanders (1997), the services marketing literature recognises that customers are intrinsically involved in the service process, a property that is often called the characteristic of inseparability (Rust et al., 1996). The inseparability of the customer from the service is highlighted by Lengnick-Hall and Sanders (1997) when they consider students as co-producers in the learning outcomes from the teaching process. Inseparability, or co-production, can be seen to be a continuum ranging from the student being intimately involved with the teaching process through to the student being a passive recipient of the teaching process. Indeed, suggesting that the “student co-producer is not usually expected to manage the overall transformation process” (Lengnick-Hall and Sanders, 1997, p. 1339) acknowledges that, in a “basic” setting, the student is not necessarily involved as intimately as in a high-involvement regime.

The treatment of the student as a product emphasises the need for the product to be examined for changes in key characteristics (e.g. competencies) and to acknowledge that the involvement of the student in the teaching process is a matter of degree. Subsequently, the emphasis in this study is to produce a baseline, where the competence development of the students is assessed in the context of a standard subject, where lectures are often low-involvement – especially with current pressures to increase class sizes, and tutorials have a moderate level of involvement and are used to enhance the lectures. Within such a typical teaching context a key remaining characteristic of the learning situation is the learning style of the student.

**Learning styles**

Learning styles are an individual's characteristic mode of gaining, processing and storing information during an educational experience (Kolb, 1984). The dominant, structuralist, approach to the modelling of how humans ideally learn, has been typically attributed to Kolb (1984).

In Kolb's (1984) model, concrete experience (CE)/abstract conceptualisation (AC) and active experimentation (AE)/reflective observation (RO) are two distinct dimensions, each representing two dialectically opposed adaptive orientations – ideas or information (White, 1992). These two dimensions of learning are equipotent modes of knowing that through dialectic transformations result in learning (Kolb, 1984). The process of experiential learning can be described as a four-stage cycle involving four adaptive learning modes – concrete experience, reflective observation, abstract conceptualisation and active experimentation.

The basis of this four-stage model is that learning, and therefore knowing, requires both a grasp or figurative representation of experience and some transformation of that representation. Either the figurative grasp or operative transformation alone is not sufficient.

The result is four different, elementary forms of knowledge. Experience grasped through apprehension (CE) and transformed through intention (RO) results in divergent knowledge.
Experience grasped through comprehension (AC) and transformed through intention (RO) results in assimilative knowledge. When experience is grasped through comprehension (AC) and transformed through extension (AE), the result is convergent knowledge. Finally, when experience is grasped by apprehension (CE) and transformed by extension (AE), accommodative knowledge is created (Kolb, 1984; White, 1992).

Kolb’s (1984) model has also been operationalised by Honey and Mumford (1992). The similarities between Kolb's (1984) terminology and the Honey and Mumford (1992) terminology are that: Kolb's Accommodator (CE and AE) appears to be equivalent to Honey and Mumford's Activist, the Diverger (CE and RO) is similar to the Reflector, the Assimilator (AC and RO) is similar to the Theorist, and the Converger (AC and AE) is similar to the Pragmatist learning style. Subsequently, the two opposite pairs of learning styles for Honey and Mumford's model are Activist-Theorist and Reflector-Pragmatist.

The Honey and Mumford terminology and the Kolb terminology are combined in the model (essentially based on Kolb, 1984) depicted in Figure 1. The learner (and teacher) can start at any stage in the cycle, although the most effective learning occurs when the learner moves around the entire cycle. The Honey and Mumford (1992) terminology is used throughout the rest of this paper.

A major factor in shaping individual learning style is the undergraduate education undertaken by the student, either by the process of selection into a discipline or socialisation while learning in that discipline, or, as is most likely the case, both (Kolb, 1984). Undergraduate business majors were found by Kolb (1984) to tend to have accommodative learning styles. However, several disciplines (especially management) are multidisciplinary and may therefore include within their boundaries considerable variation of learning styles (Kolb, 1984).

As the beginning of formal management education, the impact of undergraduate management courses on the student-as-product is critical. Prior research has examined course designs that have some notable characteristic, for example the high involvement design noted in Lengnick-Hall and Sanders (1997). However, the standard educational approach may also be valuable for its development of students and, at the least, the standard subject design is the baseline against which to compare other designs. The inseparability, or co-production, inherent to formal undergraduate programs emphasises the importance of the student in undergraduate education, especially the student's learning style. The combination of these factors leads to the two hypotheses below, which will be tested in this study: H1. Competence levels will be increased over the duration of the course. H2. There will be differences in competence changes by learning style.

Method

Sample

The participants were students at a mid-sized Australian university (approximately 19,000 full-time equivalent students). Within the university approximately 5,800 full-time equivalent students were enrolled in the business faculty. The subject “Management” is a compulsory core subject of the Bachelor of Business and is usually undertaken in the students’ first year of studies. Although the subject runs in various modes and on multiple campuses, the current study focuses on the on-campus students at the largest campus (approximately 75 per cent of
the on-campus students in the Faculty are at the largest campus). The format for any given student in the subject is two hours of lectures and one hour of tutorials per week. To control for teaching style the final sample for this paper consists of the 78 students that attended four tutorials conducted by the same academic. Of those students, 75 (96 per cent) completed the survey at both time one and time two. Of the respondents, 47 percent of the sample were female, 99 percent of the students were enrolled full-time, and 34 percent were from a non-English-speaking background.

Procedure

A “Pre, Post, Then” design was used, following the literature on change measurement (e.g. Terborg et al., 1980). Students completed the pre-measure of competencies in week two of semester, as well as the Learning Styles Questionnaire (LSQ) (the scale characteristics are detailed below).

The same classes are surveyed in the penultimate week of semester. On the second questionnaire, they respond to the competencies items twice. The first set of competence items ask for a report of their current level on the competencies as the subject drew to a close (the “Post” measure). The second set of competence items asked for a retrospective report of the level of competencies they had possessed at the start of the subject (the “Then” measure). The “Then” measure was collected to allow a more sophisticated assessment of change.

Prior research has suggested that the self-report measurement of change over time can be complicated by the respondent's changing understanding of the phenomenon being rated, due to alpha, beta and gamma change (Terborg et al., 1980). Alpha change is the direct change in the level of the variable, measured before and after an intervention, on a scale that retains a constant meaning (i.e. there is no beta change) across administrations (Pre-Post). “Given the existence of beta change, alpha change at the individual level is determined through the analysis of Post and Then scores” (Terborg et al., 1980, p. 116). Beta change occurs when the meaning of the measurement scale's anchor points change over time and can make Pre-Post comparisons invalid. Indeed, in terms of validity, Post-Then indices were more similar to objective measures of change in behaviour than traditional Pre-Post self-report methods (Howard et al., 1979; Terborg et al., 1980).

Beta change is determined by examining Pre and Then scores (Terborg et al., 1980). Notably, beta change may actually be a desirable outcome of an educational situation. That is, individuals could be expected to increase their meta-knowledge and expand their understanding of the subject taught. Gamma change is more complex, involving a fundamental change in the meaning of the issues being examined and it will also be tapped by Post-Then comparisons, although it may alter the inter-relationships between issues.

This study focuses on alpha and beta change particularly because the literature is still debating how to assess gamma change – although factor analysis appears to be a common approach (e.g. Golembiewski and Billingsley, 1980; Lindell and Drexler, 1979; Terborg et al., 1980) and because changes in factor structure could also be caused by alpha and beta change (Lindell and Drexler, 1979; Terborg et al., 1980). Gamma change may also be less applicable here because of the context that is examined. That is, fundamental shifts in what is understood as management are less likely to occur when students would already have had a reasonable understanding of what a manager does and the notion of management, and fundamental changes in their conceptualisation of management are less likely to occur as the
result of an undergraduate introductory management subject – relative to an advanced undergraduate subject or a Master's level subject for a person with a background in a different discipline.

**Measures**

The learning styles were measured using the LSQ (Honey and Mumford, 1992). Each of the four learning styles was assessed using 20 items, where a tick or cross was given a score of one and a blank was given a score of zero. The LSQ was used, rather than the Learning Styles Inventory (LSI) of Kolb (1976) due to the lack of strong reliability for the LSI in certain instances (e.g. Freedman and Stumpf, 1980, Perry and Delahaye, 1987). Further, the LSQ identifies the students’ styles directly, rather than through the multiple stage process of the LSI (Mumford, 1987). For all four scales the Cronbach alphas were moderate or good (Activist=0.67, Reflector=0.85, Theorist=0.72, and Pragmatist=0.62).

The students’ competence levels were assessed using 29 items across five main areas employing scales based on Dickenson et al. (1995), with the emphasis changed from human resource management to simply management. The five main areas were examined three times – pre, post and then. Thinking/analysing skills were assessed using ten items, Knowledge of management details was assessed using seven items, relating theory to practice (applying theory) was assessed using five items, Team skills were measured using three items, and professional and personal development (PPD) was assessed using four items. A separate scale on strategic skill levels was excluded due to the items being potentially confounded with the knowledge of management details scale, given that strategic management was an explicit component of the subject examined here. The students were asked to indicate what level of proficiency they felt they have in each of the item's areas, scored on a seven-point Likert scale from none (1), to fair (4), through to extremely good (7). The reliability of the scales for all of the measurement modes, shown in Table I were primarily good to moderate.

A range of demographics were also examined. In particular the students were asked to identify their gender, whether or not they came from a non-English-speaking background, their degree and major(s), and their employment status.

**Results**

All of the analyses below were conducted using SPSS for Windows. The initial analyses used paired-samples t-tests to examine the differences between pre and post measures of competence (called the “basic difference” here, due to the presence of beta changes – which means that this difference is not alpha change), between then and post levels of competence (alpha change), and between pre and then levels of competence (beta change).

Across all of the variables a dramatic increase was found in learning among the students. For all of the competencies the higher objective of achieving beta change in the students’ knowledge was obtained. Similarly, alpha change was also obtained for all of the generic competencies (albeit at $p<0.10$ for PPD). That is, the students not only learned a lot, but also they knew and realised that they had learned a lot.

The basic difference, pre to post, was significant across two of the competencies. For all except two of the competencies, the beta change subsumed the alpha change to the extent that the basic difference score was slightly negative, or approximately the same. For the two
exceptions, the applying theory and team skills competencies, the level of alpha change was so dramatic that it overcompensated for the beta change.

In the spirit of always aiming for continuous improvement in teaching, the next step involved examining the learning styles of the students and trying to find factors that could be tapped to enhance their learning experience further. The descriptive information about the learning styles of the students in the management subject is given in Table II.

The management students were most commonly activists or reflectors, with a reasonable proportion of theorists and only a few strong pragmatists, when using the cut-offs from Honey and Mumford (1992). In further analyses, when the learning styles across various demographics are examined, a notable finding is that non-English-speaking background students (typically Asian international students in this context) were significantly more likely to employ the reflector style. There were no differences by gender, or degree specialisation.

With a dearth of information on standardised cut-offs for the learning styles for management students, relative cut-offs were used to break the students into groups that could then be investigated for levels of competence development. Subsequently, the learning styles scores were split into three evenly-sized groups. Difference variables were created for each of the basic, alpha and beta changes in competence. Those difference variables were then examined across the trichotomous (low, medium, high) learning styles variables.

The key findings in Table III are that those students who were low on the activist learning style gained significantly more, prima facie, applying theory competence than medium scoring activists. There was also a tendency for low and medium activists to gain more PPD competence than high activists, who lost PPD competence. Furthermore, students with a low activist learning style had negative beta change on the PPD competence – whereby they initially over-estimated their PPD competence, than the high activists who initially under-estimated their PPD competence.

For the pragmatist variable, students with a low level of pragmatist learning style gained significantly more thinking/analysing competence than the medium-level pragmatists, who also gained but not as much at that competence. Students with a moderate level of pragmatist learning style also initially under-estimated their PPD competence level significantly more than high pragmatists who initially over-estimated. There were no significant differences in competence changes for any of the competence areas across the reflector learning style.

Finally, the students with a moderate level of theorist learning style tended to gain more competence, prima facie, at knowledge of management details than low theorist students.

**Discussion**

The results above support the first hypothesis in that the competence levels of the students increased, across all of the competencies, over the duration of the course. The second hypothesis was only weakly supported. There were a few differences in competence changes by learning style, but not very many.

Across all of the competencies there were significant alpha and beta changes. Similarly, the basic difference, pre to post, was significant across two of the competencies. The significant basic difference for the applying theory competence appears to be the result of the large alpha change, specifically an alpha change that was larger than the beta change. Conversely, the
significant basic difference for the PPD competence appears to be the result of the beta change overwhelming the amount of alpha change.

Six of the changes in competence were notable across the learning styles. However, the key message here is that the majority of the competence changes were the same across learning styles. That is, the learning styles did not have a clear differential impact on the competence changes. Of the changes in competence that did occur across learning styles, all three levels of activists may need some support, particularly regarding the PPD competence. However, as demonstrated in the first hypothesis, *prima facie* change may not be as important an issue as alpha and beta change. The pragmatists appear to do well across the competencies, despite the differences found. The findings for the pragmatists are more about optimising the learning, rather than a sub-group not developing. The lack of a negative impact here is even more notable if any beta change is considered a worthwhile change. That is, if the students learn more about their meta-competence, whether that adjustment is up or down, they could be seen to have learned. Again, for the theorists, *prima facie* change may not be a critical issue. Although in this case, the findings are a confirmation of Kolb's model in that low theorists were the students not grasping the knowledge of management details as directly as other students.

Across these results, the only finding of negative note, for the students, is that the high activists have a tendency (apparently) to lose PPD competence (in alpha change terms). The only other alpha change that was found was more a matter of who gained most (thinking/analysing) competence, rather than any sub-set losing competence.

In terms of the overall Kolb (1984) model, most of the differences by learning style were on the left-hand side of Figure 1. That is, the mechanism of active experimentation is common to most of the differences found. The horizontal dimension of Figure 1 is the active-reflective dialectic. This dialectic is a process of transformation and represents the two opposing means of transforming that grasp experience – either through internal reflection, called intention, or active external experimentation, called extension (Kolb, 1984). The general pattern of the findings may be a reflection of the classroom-based approach used in the standard subject design tested here. Although of the results, the only result with a clearly negative impact would entail that high activists may want a little more hands-on material in the design, to develop their PPD competence. However, for all of the other competencies the high activists developed as much as the other learning styles and all of the other learning styles developed well across all of the learning competencies.

These findings also provide strong support for the use of the more sophisticated change-assessment techniques to be employed when investigating educational development, rather than the use of pre-post or cross-sectional measurement designs. In particular, once a basic difference score is broken into its constituent alpha and beta elements, the true forces behind changes in the competencies can be determined.

The value of a standard subject design

Overall, this study found that even a standard subject design had a significant and substantial impact on the (management) competence development of the students. When these competence changes are examined across student learning styles they were found to be reasonably consistent, although there were a few differences.
The establishment of this baseline allows comparisons with alternative subject designs to be made on a systematic basis. A subject with a standard format of two hours of lectures and one hour of tutorial per week was found to result in significant alpha and beta change across all of the competencies examined here. The relative consistency in competence development across learning styles may have been due to the tutorials containing exercises that worked through all four stages of the learning cycle (Kolb, 1984), despite being only one hour per week. Working through the entire learning cycle may also account for the overall alpha and beta changes across all of the competence areas. Although the impact of working all the way through the cycle and then obtaining the even results, in terms of competence development, may also have been a product of having a variety of learning styles present – a possible product of self-selection into a relatively multi-disciplinary subject such as management. Again, the issues here are intertwined, reflecting the inseparability, or co-production, inherent to formal undergraduate programs.

The findings above highlight the value and impact of a standard design course. Alternative designs such as the high-involvement approach of Lengnick-Hall and Sanders (1997) and the designs described in Bigelow et al. (1999) and Shaw and Fisher (1999), are examples of designs that would want to prove a differential advantage to the student-as-product.

A specific finding that may be of some note was the significant difference in learning style found for students from a non-English-speaking background. The higher reflector scores of these students entails that when teaching non-English-speaking background (typically Asian international students in this case) students the educator may wish to use more reflector-friendly teaching techniques. For example, reflector-friendly techniques to be emphasised could include: allowing or encouraging them to watch and ponder over activities; observing groups at work; taking a back seat in a meeting; being given time to prepare; read in advance a brief giving background data; and they can be helped to exchange views with others without threat of danger – such as when there is prior agreement, within a structured learning experience (Honey and Mumford, 1992). Similarly, the educator may want to consider avoiding forcing these students into the limelight, and to avoid being involved in situations without allowing them to plan, or if there are overt time pressures.

From a measurement perspective, implicit throughout many of the findings above is that, for students-as-products, educators should want the students to have beta change in their competence. Basic change, while a gain, does not go far enough. For example, in Table IV two of the basic changes were significant (and one of those was negative – a nonsensical finding). In terms of alpha and beta change however, the results make more sense. Subsequently, examining changes in students should use research designs such as the pre, post, then design used here, or other rigorous methods, rather than simple pre and post measures.

**Limitations**

The context investigated here may not be standard in a variety of other settings across the world. Indeed, one of the agendas of this paper is to try to flush out reactions that would help the field of management education develop a range of design options and an enhanced awareness of the range of designs used across the world. Subsequently, other designs need to be tested, across higher level subjects, through alternative learning modes (e.g. distance education), over the duration of the degree and in different cultures.
Conclusion

From the perspective of students-as-products, the baseline provided here allows for the testing of alternative designs of educational systems, whereby alternative designs will have to prove a benefit above and beyond that of the standard teaching system. The development of management competence was reasonably consistent across learning styles, although this result may also have been a result of following the guidelines of Kolb (1984) by working through the entire learning cycle, thereby addressing all learning styles. The Pre, Post, Then research design was found to be quite powerful and found results far superior to that of a simple pre-post design. In assessing changes in the students-as-products, the pre, post, then design is highly recommended.

Future research may want to test the above competence development for different designs and across a variety of contexts. Further, the variety of learning styles of the people developing management competencies may be more amenable to informal, on-the-job development as a complement to formal education. Whatever these alternative designs contain, they now have a baseline to compare themselves to. Similarly, examining students at each stage of their management development will highlight the differential impact of various subjects on specific management competencies.

Figure 1 Kolb's learning cycle
Table I

<table>
<thead>
<tr>
<th>Scale</th>
<th>Pre</th>
<th>Post</th>
<th>Then</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thinking/analysing skills</td>
<td>0.75</td>
<td>0.81</td>
<td>0.87</td>
</tr>
<tr>
<td>Knowledge of management details</td>
<td>0.86</td>
<td>0.85</td>
<td>0.87</td>
</tr>
<tr>
<td>Applying theory</td>
<td>0.87</td>
<td>0.77</td>
<td>0.91</td>
</tr>
<tr>
<td>Team skills</td>
<td>0.86</td>
<td>0.82</td>
<td>0.90</td>
</tr>
<tr>
<td>Professional and personal development</td>
<td>0.67</td>
<td>0.75</td>
<td>0.68</td>
</tr>
</tbody>
</table>

*Table I. The Cronbach alpha scores for the competence scales*

Table II

Descriptive summary of student learning styles

<table>
<thead>
<tr>
<th>Learning style</th>
<th>Percent very low or low</th>
<th>Percent strong or very strong</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activist</td>
<td>9</td>
<td>46</td>
</tr>
<tr>
<td>Pragmatist</td>
<td>46</td>
<td>21</td>
</tr>
<tr>
<td>Reflector</td>
<td>28</td>
<td>55</td>
</tr>
<tr>
<td>Theorist</td>
<td>38</td>
<td>32</td>
</tr>
</tbody>
</table>

*Note: Based on the standardised cut-offs given in Honey and Mumford (1992)*

Table III

The differences in competence change by learning style

<table>
<thead>
<tr>
<th>Competence criterion</th>
<th>Activist</th>
<th>Learning style</th>
<th>Pragmatist</th>
<th>Reflector</th>
<th>Theorist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thinking/analysing skills</td>
<td>Nil</td>
<td>Alpha (Post-Then)*</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>Knowledge of management details</td>
<td>Nil</td>
<td>Nil</td>
<td>Beta (Pre-Then)*</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>Applying theory</td>
<td>Basic (Post-Pre)*</td>
<td>Nil</td>
<td>Beta (Pre-Then)*</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>Professional and personal development</td>
<td>Alpha (Post-Then)**</td>
<td>Beta (Pre-Then)**</td>
<td>Beta (Post-Pre)**</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>Team skills</td>
<td>Nil</td>
<td>Nil</td>
<td>Beta (Post-Then)**</td>
<td>Beta (Pre-Then)**</td>
<td>Nil</td>
</tr>
</tbody>
</table>

*Notes: * p = 0.05; ** p = 0.10

Table IV

The changes in competence for a standard design management subject

<table>
<thead>
<tr>
<th>Competence area</th>
<th>Basic difference (Pre-Post)</th>
<th>Alpha change (Then-Post)</th>
<th>Beta change (Pre-Then)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre mean</td>
<td>SD</td>
<td>Post mean</td>
</tr>
<tr>
<td>Thinking/analysing skills</td>
<td>48.28</td>
<td>4.61</td>
<td>48.11</td>
</tr>
<tr>
<td>Knowledge of management details</td>
<td>30.79</td>
<td>3.70</td>
<td>30.65</td>
</tr>
<tr>
<td>Professional and personal development</td>
<td>20.08</td>
<td>2.64</td>
<td>18.98</td>
</tr>
<tr>
<td>Team skills</td>
<td>15.36</td>
<td>2.40</td>
<td>15.85</td>
</tr>
</tbody>
</table>

*Notes: Cell sizes vary between 36 and 47, per pair comparison. * p = 0.05; ** p = 0.005; *** p = 0.10

References


Further Reading