Path analysis on the teaching image of engineering teachers in Taiwan

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ABSTRACT: The purpose of this study was to investigate a suitable model of the teaching image of engineering teachers in Taiwan's senior vocational high schools. Stratified sampling was used to differentiate the country into four regions: northern, central, southern and eastern regions, with a random sampling of teachers in 32 schools, collecting data through *a model of teachers' teaching image on the senior vocational high school scale*. The Structural Equation Model (SEM) was used to undertake statistical analysis. From this study, the main connotations of *influences of teaching thought* of the *Bureaucratic School Culture* and the *Internal Locus of Control* were found. Among these, information exchange from the latter compared to the former. Meanwhile, the teachers' experiences interflowing from domestic vocational senior high schools tend to share both teaching plans and class management. The results and contributions are discussed in this article.

INTRODUCTION

Teaching image refers to the teaching deliberations shown by teachers when faced with teaching environments, problems and teaching behaviour adopted after receiving information [1-3]. Teaching points at teachers and students who carry out *teaching* and *learning* in a dynamic teaching environment. This progress would require teachers to make a range of teaching judgments and decisions continuously in order to maintain teaching quality effectively [4][5]. Ballard and Bates emphasised that both the good or bad and the success or failure of teaching lies in how teachers define the teaching environment, carry out deliberations, and recognise their personal roles [4]. Besides planning teaching activities properly, professional teachers must be able to self-examine and evaluate their teaching plans after teaching as references in their future teaching process [6]. Therefore, this is the annotation of teaching image.

At present, the academic world in Taiwan still has some doubts about the connotations and influencing factors of the teaching image, and teaching image model of vocational senior high school teachers is seldom researched [7][8]. Moreover, Lee emphasised that the talents fostered at vocational senior high schools have a mutual relationship with the development of Taiwan's economy [1]. Chen's view was that vocational senior high schools are the lifeline of Taiwan's economic development, thereby showing the importance of teaching image [2]. Thus, it is a priority to develop a suitable teaching image model for our local engineering teachers.

This study tried to identify the factors that affect vocational senior high school teachers' teaching image by path analysis, and to build a teaching image model for those teachers by discovering the impact between teaching deliberations and teaching behaviour when having information-sharing. The importance of teaching deliberations, information-sharing and teaching behaviour have been identified, as these are crucial parts of the teaching process, but the contents above lack a comprehensive research model [9-12]. Therefore, this research examines the influences of teaching image factors on vocational senior high school teachers and proceeds to mould teaching image models in order to provide appropriate suggestions for the enhancement of vocational education. In summary, the objectives of this research are as following:

1. To understand the factors that influence the teaching image progress of vocational senior high school teachers.
2. To prove that there is a mutual relationship among teaching deliberations, information-sharing and teaching behaviour of vocational senior high school teachers.

LITERATURE REVIEW

Based on the above background and motivations, the related literature of the factors that influence teaching deliberations, information sharing and teaching behaviour are examined. The contents of teaching image progress and research hypotheses are generalised into the following:

Teaching Image Progress

Teaching deliberations are the perceptions, introspections, problem solutions, concept arrangements and decisions before, within and after teaching activities, which describe psychological characteristics and cognition of teaching. Summing up, the factors that influence teaching deliberations include the stratified school culture and internally controlled moral characteristics.

Teachers are the main members of the school organisation. Teachers' teaching deliberations are influenced by a school's culture [9][13]. Leithwood's research found that under the influence of this stratified culture, teachers' teaching deliberations will become conservative, but at the same time, it is beneficial in allowing teachers to have sound teaching plans, forming an orderly standardised teaching consensus [14]. Ash and Persall showed that stratified school culture is beneficial for teachers' self-examination [15]. Huang and, Parkay and Stanford pointed out that a stratified school culture has a strong and positive effect on experience sharing and self-examination among teachers [11][16]. However, Ash and Persall considered that there is no relationship between the communicative interaction of school members and organisational culture types, despite those teachers' individual moral characteristics having a relatively positive association [15].

Teachers' moral characteristics are important because of the influence of internally controlled moral characteristics on the factors influencing teaching deliberations [10]. The research of Tsai and Roy showed that teachers with internally controlled moral characteristics have a more positive consciousness toward teaching deliberations [17][18]. Internally controlled teachers maintain an optimistic attitude toward teaching, and tend to put greater demands on themselves to achieve better teaching objectives, willing to self-examine themselves and share teaching experiences with their colleagues [5]. Barnett et al also considered that internally controlled teachers take more initiative and enjoy discussing teaching experiences with colleagues in order to improve their teaching expertise [10].

Information sharing occurs when teachers share teaching experiences with colleagues through formal or informal means, and receive feedback and achieve introspection during the process. Categorising the above contents, the influencing factors of information sharing include experience sharing and self-examination.

Sharing experiences is an important source of information sharing [4]. Experience sharing uses the contents of teaching experiences and carries out information sharing through in-depth discussions [1]. Teachers' information sharing requires an adjustment of contents of sharing due to teaching situations and real needs. By experience sharing, teachers could have the chance to accumulate teaching experiences or to encourage self-examination [4][13]. The sharing of experiences of newly appointed teachers is mostly related to class management [19]. The experiences of teachers who have worked for more than four years come mostly from their own knowledge or from the results of sharing experiences with their colleagues [11].

Mertler considered that teachers' self-examination is an important factor in professional growth, and it directly influences teachers' teaching quality [20]. In addition, being able to improve teaching quality, the teachers' self-examination ability is also beneficial in their class management [7][20]. Self-examination can assist teachers with timely adjustments when facing the teaching environment and have a direct effect on class management, influencing teachers' professional development capability indirectly [11].

Teaching behaviour is teachers' practical outcome according to teaching aims, contents, and responses from students. In summary, the factors influencing teaching behaviour include teaching plans, class management and professional capability.

Huang suggested that teachers should make teaching plans before teaching in order to use them as the basis for teaching behaviour [16]. Teaching plans point to series of choices, organisations and arrangements based on prepared knowledge of social cultural values, subject and students' knowledge, and the experiences and interests of teachers toward course objectives, contents, activities and evaluations [21]. Mertler clearly pointed out that teaching plans procure the blueprints of teaching results [20]. The standards of teachers' teaching behaviour are based on pre-planned teaching strategy, used as a series of activities to teach and guide students in their learning [12].

Class managements include: class administrative operations, teaching operations, self-governed activities, normal student counselling, class environment, class atmosphere, etc [19]. The elements of people, matter, time, place and things are also included. At present, the conflict between teachers and students in Taiwan's vocational senior high school is mainly due to a combination of communication skills, students' deviated behaviour and the drop in teachers'

and students' expectations [5]. Through the mutual exchange of class management discussions by teachers, students' physical and mental development and learning difficulties can be effectively understood as future references of teachers' teaching behaviour [13].

Professional capability directly influences teachers' teaching behaviour [16]. Berg, Aaronson et al, and David and Neil consider that teachers' professional capability has a positive effect on their teaching behaviour and is beneficial for maintaining teaching quality and results [3][7][12]. Malcolm also found out that teachers' professional capability can promote their confidence, which is positively beneficial for their teaching behaviour and class management [5].

Research Hypotheses

Concerning stratified school culture and according to the differences in the research of Barnett et al, Parkay and Stanford, Ash and Persall, this study has established as its first research hypothesis (H1) that: there is a positive relationship between a stratified school culture and teachers' teaching experiences [10][11][15]. Moreover, based on the views of Tsai; Roy; and Huang on the mutual interaction between stratified school culture and teachers' self-examination, this research established as its second research hypothesis (H2) that: there is a positive relationship between the stratified school culture and teachers' self- examination [16-18] .

Next, Pan showed that the factors influencing information-sharing come mainly from teaching experiences and self-examination [13]. Nikos and Emily; Huang; and Ash and Persall also considered that if one has internally controlled moral characteristics, he or she is more likely to share teaching experiences [15][16][22]. Based on the above statement, this research established as its third research hypothesis (H3) that: there is a positive relationship between internally controlled moral characteristics and the sharing of teaching experiences. Also, Nikos and Emily; Ash and Persall; and Tom et al considered that internally controlled moral characteristics are beneficial to teachers' self-examination, and the fourth research hypothesis (H4) of this research is therefore that: there is a positive relationship between internally controlled moral characteristics and the teachers' self-examination [6][15][22].

Academics mainly use teaching plans or class management as the basis of sharing their teaching experiences [20]. From this notion, this research established the fifth research hypothesis (H5) that: there is a positive relationship between the teachers' experience sharing and teaching plans. Chen, and Parkay and Stanford considered that teachers' sharing of experiences is mainly based on class management, and this research addressed the sixth research hypothesis (H6) that: there is a positive relationship between teachers' experience-sharing and class managements [11][19] .

Moreover, as to whether self-examination has a positive effect on teachers' teaching plans before they start the class, this research established as its seventh research hypothesis (H7) that: there is a positive relationship between self-examination and the teachers' teaching plans. In addition, based on research results from Fan; Chen; and Mertler, this research's eighth research hypothesis (H8) is that: there is a positive relationship between self-examination and class management skills [8][19][20]. Finally, the ninth research hypothesis (H9) is that: there is a positive relationship between self-examination and the development of teachers' professional capability.

RESEARCH DESIGN

The research uses inventory investigation in order to achieve the above-mentioned research objectives. The research framework, research tools and model testing methods as explained below.

Research Framework

Based on the review of the literature, the mutual relationship between factors explained in hypotheses H1- H9 and the mutual affects produced among them can be shown in the following research frameworks (Figure 1). These frameworks have been labelled x1 to x7, in order to reference them throughout this article.

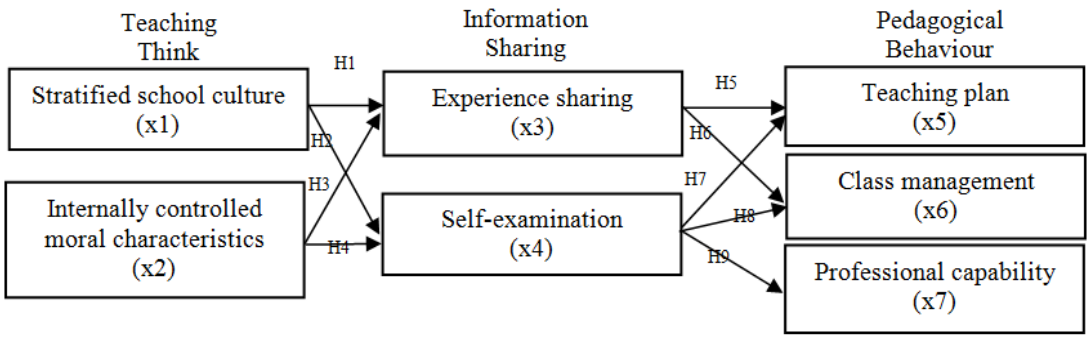

Figure 1: Research framework.

The teaching image progress of this research mainly examines the relationship between teaching deliberations, information sharing, and teaching behaviour. The functional relationship between them is as follows: x3 = f(x1, x2); x4 = f(x1, x2); x5 = f(x3, x4); x6 = f(x3, x4); x7 = f(x4). In this model, x1 and x2 are the original variables, with x3 and x4 being reactive values to x1 and x2; x5 – x7 are reactive variables to x3 and x4.

Research Targets

This research uses Stratified Random Sampling, to select groups of 10, 8, 10, and 4 schools respectively (total of 32 schools) in the northern, central, southern and eastern regions of Taiwan. Three hundred and eighty-four inventories were issued and 315 effective ones were retrieved, with a retrieval rate of 82.0 %. Among the testing samples, most of the teachers were between 31-40 years old, occupying a total ratio of 35.9%; those with college degrees occupied 54.9%, followed by those with Master's degrees, among which included teachers working for 1-4 years, occupying the largest ratio of 42.3%.

Research Tools

Based on research by Nunally and Bernstein, Cronbach's α coefficient greater than 0.7 determines the basis of reliability [23]. Establishing the validity of the inventories requires a validation of both the contents and constructive. This also accords with the discussions of Hair et al [24]. Stratified Random Sampling was used with groups of 8, 6, 8, and 2 schools, respectively (total of 24 schools). 186 inventories were issued and 142 effective inventories were retrieved, with a retrieval rate of 76.34 %. The Cronbach α value of pre-test retrieval of effective inventories was between 0.64 ~ 0.86, and the Cronbach α value of the total scale was 0.93. Nunally and Bernstein suggest that the pre-test value should be above 0.6, which shows the reliability of the pre-test scale [23].

DATA ANALYSIS

Figure 2 shows that in the *influencing factors of teaching deliberations* framework, there is a significant mutual influencing relationship between *stratified school culture* (x1) and *internally controlled moral characteristics* (x2) (standardised coefficient = 0.385, $p < .01$). In addition, there were some influences between *stratified school culture* (x1) and *experience sharing* (x3) ($p < .05$), but there was no significance with respect to *self- examination* (x4). Further, *internally controlled moral characteristics* (x2) exerted a significant effect on *experience sharing* (x3) and *self-examination* (x4) (standardised coefficient = 0.522, .437, respectively, $p < .01$). From the results obtained, it can be established that *stratified school culture* (x1) and *internally controlled moral characteristics* (x2) are the important factors that influence *influencing factors of teaching deliberations*. This discussion is consistent with the research results produced by Tsai; and Roy, and *internally controlled moral characteristics* have more of an influence on the *influencing factors of information sharing* than they have on *stratified school culture* [17][18]. This research, then, has pointed out that with the models used in the teaching image of vocational senior high school teachers; *stratified school culture* (x1) has no influence on *self-examination* (x4).

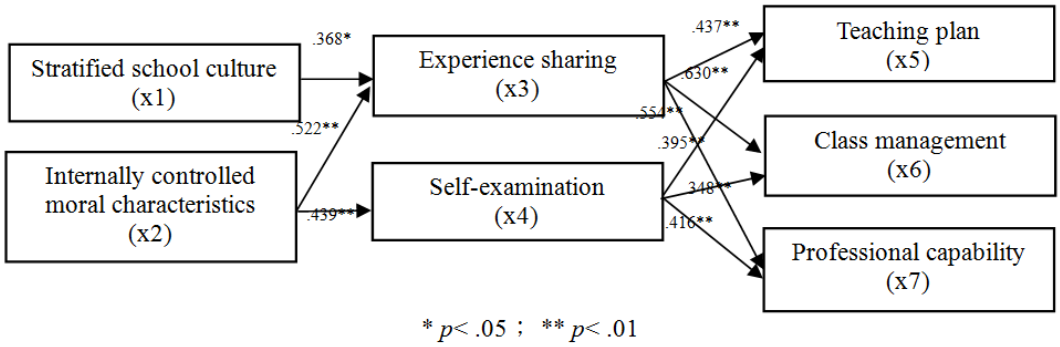

Figure 2: Teaching image model of vocational senior high school teachers.

RESEARCH FINDINGS AND DISCUSSIONS

This research inferred that there is a mutually influencing relationship between the professional growth of teachers with stratified school culture and internally controlled moral characteristics. Teachers with internally controlled moral characteristics have a greater and more positive influence than those controlled by external forces [10]. This is beneficial to form a stratified school culture trend. *Internally controlled moral characteristics* (x2) have a more positive influence on *information sharing* than *stratified school culture* (x2), and this conforms to the research results of other academics [16-18]. In other words, one of the reasons for forming a stratified school culture is because of the influence of those teachers with internally controlled moral characteristics, and if these teachers have the highest rate of internally controlled moral characteristics, then it is possible that this will allow the schools to form stratified systems.

In *the influencing factors of information sharing* structure, the related coefficient of *experience sharing* (x3) and *self-examination* (x4) is 0.390, $p < .01$. Again, the *experience sharing* contents include the imparting of teaching plan experiences, personal thoughts about class managements and specialised ability (x7), among which *class management* received the highest importance from vocational senior high school teachers, which is significantly higher than the other two. This point is consistent with the viewpoints of Chen, and the research samples are deviated toward the newly appointed teachers, conforming to the research results of *class management* viewed by Parkay and Stanford, while Parkay and Stanford considered that teachers who have worked for more than four years give more importance to class management [11][19]. This does not conform to the research findings of this research; however, *self- examination* (x4) has a positive influence on the *teaching plan* (x5), *class management* (x6) and *professional capability* (x7) of *the influencing factors of teaching behaviour* (the related coefficients are 0.395, 0.348 and 0.416, respectively), which demonstrates that if teachers do, indeed, have self-examination capability, it is then the key factor that influences teaching behaviour.

Generalising from these research findings, *stratified school culture* does not have much significant influence on *self-examination* and this is consistent with the viewpoints of Leithwood, but not with the viewpoints of Tom et al; Ash and Persall; and Huang [6][14-16].

In addition, this research has shown that the research hypothesis that *stratified school culture and teachers' self examination* did not produce the same results as other research, whereas the rest of the hypotheses produced the results that were similar to those obtained in other research (as shown in Table 1).

Table 1: Tested results of research hypotheses.

Planned research hypotheses		Tested results
H1	There is a positive relationship between stratified school culture and teachers' experience-sharing	✓
H2	There is a positive relationship between stratified school culture and teachers' self-examination	×
H3	There is a positive relationship between internally controlled moral characteristics and teachers' experience-sharing	✓
H4	There is a positive relationship between internally controlled moral characteristics and teachers' self-examination	✓
H5	There is a positive relationship between teachers' experience-sharing and pre-planning of teaching plans.	✓
H6	There is a positive relationship between teachers' experience-sharing and class managements	✓
H7	There is a positive relationship between self-examination and pre-planning of teaching plans	✓
H8	There is a positive relationship between self-examination and class management skills	✓
H9	There is a positive relationship between self-examination and professional capability development	✓

Remark: ✓Approved; × Disapproved.

CONCLUSIONS

If teachers can conform to real teaching needs based on the teaching environment, differences in targets, design, and adjustment of teaching plans, then the students' learning results will be better [16]. This process is activated by the schools' administrative system, from the sharing of experiences among the teachers, or from teachers' individual self-initiated behaviour. Categorising the results of the above data analysis, one can draw the following conclusions from this research:

1. Information sharing definitely exists between teaching deliberations and teaching behaviour, and it plays a key intermediary role.

Teaching deliberations is the starting point of the teaching image model for vocational senior high school teachers, while *stratified school culture* and *internally controlled moral characteristics* have a significant influence on *information sharing*. In other words, whether it be *stratified school culture* or *internally controlled moral characteristics*, *teaching behaviour* is influenced by *information sharing*. Moreover, the effects of *information sharing* on *teaching deliberations* and *teaching behaviour* definitely exist, and play a key role; among which, *experience sharing* on *information sharing* is more significant than *self-examination*, and it shows significant standardisation of related coefficients in *teaching plans* and *class management*.

2. *Internally controlled moral characteristics* will positively influence *experience sharing* and *self-examination*, and *experience sharing* and *self-examination* will have a positive influence on *teaching plan*, *class management* and *professional capability*.

This research concludes that the summarised cores of the teachers' teaching image model, which points at the teachers with *internally controlled moral characteristics*, will positively influence *experience sharing* and *self-examination*. At the same time, *experience sharing* and *self-examination* will have a positive influence on the *teaching plan*, *class management* and *professional capability*. The results of this model conform approximately to the research conclusions of academics mentioned earlier, but the negative effects of *internally controlled moral characteristics* and *professional capability* may be worth of further examinations. The researchers have considered that maybe because newly appointed teachers represented 42.3% of the samples, the teachers at this stage face new colleagues, student problems, and parental pressures, besides their own self-required familiarity with the course contents and, therefore, those inexperienced teachers must put in more effort in the class management. Finally, the teaching image model of this research showed that if the effects of *professional capability* (through *self-examination*), of those teachers with internally controlled moral characteristics ignore self-examination opportunities, then there will be a bad influence on the improvement of the professional capability of the teachers.

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