The Perspectives of Science and Engineering Master's Students on the Mentoring Relationship

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Abstract

The purpose of this paper is to describe the experiences of Taiwanese science/engineering master's students interacting with their mentors/advisors. The study used the qualitative method of phenomenology and involved sixteen master's students from a research-oriented university in Taiwan, which is a male dominated culture and values hierarchical status. The findings reveal that to avoid conflict with their advisors and to survive in a power difference structure, the participants chose to adjust themselves. A good counselling programme which helps advisees to choose advisors, along with a supportive advisor-changing system, therefore, is encouraged. Peer monitoring and a vice-advisor system are advised as well.

Key words: Supervising relationship, Mentoring relationship, Advisor-advisee relationship

Introduction

In academia, many scholars and other academics view the advisor-advisee/mentor-mentee relationship as crucial for graduate students over the course of their professional development. The quality of such a relationship is a critical indicator for their adjustment to and success in graduate school (Rice et al., 2009). Since the relationship between an advisor/mentor and a graduate student/mentee is so vital to both the successful completion of the graduate student's research and the attainment of their master's or doctoral degree, an understanding of the dynamics of such a relationship and the effects on graduate students can be of great significance. This is especially true given that over a 10 year period, the number of graduate students in Taiwan has nearly doubled. According to statistics released by the Department of Statistics at the Taiwan Ministry of Education (2011), the number of graduate students in Taiwan has increased from 103,000 in 2001 to 219,000 today. Within the graduate student body, 84.47% of them are master's students. With regard to their field of study, 46 % are in science and technology-related fields, 31.72 % are in social sciences, and the remaining 22.28% are in the humanities

(Ministry of Education, 2011). Yet, despite this increase in the number of graduate students, little attention has been focused on their perspectives with regard to their mentors/advisors and what kind of role this relationship plays.

Of particular interest is how the traditional Chinese culture, strongly influenced by thousands of years of Confucian thought, has impacted the academic culture of Taiwan. In the science and engineering field in Taiwan, for example, there is an atmosphere of masculine competition and a hierarchy of authority (Han, 2009). In these fields, men have comprised the majority, so they have traditionally played a dominant role in science and engineering studies in Taiwan (Han, 2009; Lin, 2011). Due to the fact that most advisors shoulder more advisees than what they can manage, master's students, in general, have limited interaction with such authoritative advisors, who often provide instrumental support but little psychosocial support (Chang, 2005). This then opens up a number of interesting questions: How do these advisors/mentors develop mentoring relationship with their master's students? How do their advisees/mentees respond to mentoring under the auspices of a highly patriarchal, authoritative system? Do advisees feel the traditional cultural framework of mentoring in Taiwan to be a burden or a benefit? What are the typical dynamics of an academic mentor-mentee relationship within this system? Can successful, productive mentoring relationships, particularly ones that benefit the advisee, flourish? A question of particular interest is what challenges are associated with building mentoring/advising relationship within the masculine, hierarchical context of science/engineering graduate schools in Taiwan. Most importantly, within science/technology programmes, does such a patriarchal culture impede the quality of advisor-advisee interactions?

Although there are a number of research studies focused on the advisor-advisee relationship in Taiwan (Chang, 2004; Chen, 2006; Ho, 2003; Lee, 2010; Lin, 2006; Liu, 2007; Yang, 2000), most of them reported findings based on quantitative survey results. While a quantitative inquiry facilitates a broad understanding of the relationship and presents statistical information between variables, it cannot provide an in-depth view of a topic which has a very human component. In contrast, a qualitative inquiry, with its specific strength in obtaining culturally specific information from a particular population, could provide insights through qualitative/comprehensive information. Furthermore, it could unveil potential themes in the relationship that may not have been uncovered in previous research. In order to provide complex textual descriptions of the advisor-advisee interaction, and expand and deepen our understanding of the dynamic quality of the relationship, this study employed a phenomenological approach to uncover the interaction between advisors and advisees, particularly from the perspective of science and engineering graduate students, and in a society which practices masculine competition and a hierarchy of authority.

Definitions of Advisor, Advisee, Mentor, and Mentee

The terms advisor and mentor are used interchangeably in this paper, as are the terms advisee and mentee. An academic advisor or mentor is someone in a position of experience and authority, most often a professor with a number of years of teaching and research experience, who assumes the task and role of helping and guiding those with little or no experience in the advisor's academic field. The advisee or mentee, on the other hand, is someone with much less experience in a particular field of study, generally a graduate student, who needs and can benefit from the knowledge, advice, and experience of a mentor.

Roles in the Graduate Advisor-advisee Relationship

In general, graduate mentors primarily serve in the formal roles of academic advisor, dissertation chair, or research supervisor. However, they are also expected to help students clarify and set realistic goals, discuss research directions/topics, and assist students in making informed and responsible decisions, as well as monitor their progress and provide them with timely advice (Williams-Nickelson, 2009). In addition, mentors provide psychological support to advisees (Fagenson-Eland et al, 1997; Kram, 1985; Wang 2006), offer networking and instrumental help (Kram, 1985; Tenenbaum et al., 2001), and serve as spiritual guides (Chien, 2009). Furthermore, advisors may give financial support and individual consultation (Johnson & Huwe, 2002; McGuire & Phye, 2006), provide teaching assistant opportunities for advisees to familiarize themselves with an academic and teaching career (Liu, 2007), guide them to explore career orientation, and encourage them to participate in professional groups to strengthen professional identity (Lehker & Furlong, 2006; Weidman et al., 2001).

Graduate students, on the other hand, are expected to be aware of the requirements of study, observe academic deadlines, report research progress, finish proposed research, and recognize the shared responsibility in the advising relationship. In addition to work on their own study and experiments, graduate students often serve as teaching, research, and/or administrative assistants for advisors, labs, and/or graduate schools. They not only complete research tasks for their thesis but also assist the advisor in teaching courses, managing the lab, mentoring junior students, and assisting with other administrative tasks. Learning how to facilitate the faculty-student relationship is central to helping graduate students complete the graduate programme (Tanner, 2002).

The Importance of the Advisor-advisee Relationship

The advising or mentoring relationship is one of the most important interpersonal interactions associated with academic success in educational and training settings (Chiles, 2007). In terms of the interpersonal components of the advising relationship, students who are more satisfied describe more positive alliances with their advisors, improvements in these relationships over time, and more comfort in

disclosing professional information (Chen, 2006; Schlosser et al., 2003). From the perspective of the graduate student, a satisfactory advising relationship is based on the advisor's support, mentoring, inspiration, and encouragement (Liu, 2007; Love et al., 2007). In particular, the support provided by advisors can be a major determinant of advisees' learning satisfaction (Liu, 2007). Successful learning outcomes and academic achievement are positively influenced by a good advisor-advisee relationship (Chen, 2006; Lee, 2010). Most notably, research-related mentoring has a direct impact on students' research productivity (Hollingsworth & Fassinger, 2002). In contrast, graduate students who lack enough help from their advisors may feel disoriented (Aspland et al., 1999).

Advisory System at Graduate Schools

The production of young scholars at the graduate level occurs primarily through a mentoring process (Reynolds et al., 2008). Identification with a mentor is one of the primary tasks of mentees early in their careers (Russell & Adams, 1997). Maher et al. (2004) observed that doctoral students with better mentoring finished their degrees within 4.25 years, while other graduate students took 6.75 years or longer. With good mentorship at graduate school, graduates often received higher income, more rapid promotion, and career eminence (Russell & Adams, 1997). Additionally, they were more willing to mentor others and had better career satisfaction and achievements (Russell &Adams, 1997).

Advisor-advisee matching
The match between an advisor and advisee can make a crucial difference. Matches of the same gender, ethnicity, or race usually enhance the mentees' sense of support and commonality of experience (Watkins et al., 2007). On the other hand, if advisors' or advisees' needs are either incongruous or unmet, the mentorship is likely to suffer (Johnson & Huwe, 2002). The better the mentoring relationship, the better the research performance of advisees (Chen, 2006; Lee, 2010).

Effective advisors
According to Johnson (2002), desirable mentors are intelligent, caring, flexible, empathic, patient, and appropriately humorous. Highly rated mentors are ethical (Kitchener, 1992), psychologically well-adjusted (Cronan-Hillix et al., 1986), intentional role models (Gilbert, 1985), interpersonally supportive, encouraging, poised, kind, healthy, and competent (Johnson, 2002), and willing to share and show positive attitudes toward students (Cronin-Hillix et al., 1986). Good advisors are instrumental in providing assistance and psychosocial help, and are willing to spend time in research activities with their graduate students; moreover, they are open to the research ideas of their graduate students (Forehand, 2008). Johnson (2002) noted that an effective mentor discerns a protégé's personal and vocational dream, endorses this as realistic, and offers an environment conducive to facilitating this dream.

Dysfunctional advisors

In a graduate school setting, a dysfunctional mentorship is sometimes rooted in the behaviour or personality of the mentor or mentee (Johnson & Huwe, 2002). For instance, the faculty member might indicate a lack of time and interest in advising, mentoring, and assisting students. Even worse, some mentors have been described as corrosively critical and demanding, or jealous and sabotaging (Johnson & Huwe, 2002). When one or both parties determine that the cost of relationship maintenance outweighs the benefits, mentorship might become dysfunctional (Eby, 2007).

Methodology

Phenomenology aims at studying the phenomena as experienced by conscious beings, and it is a method for studying such phenomena (Giorgi, 1985). In addition, phenomenological research entails a careful description of people's ordinary conscious experiences, and illuminates the meaning of individual subjective experiences. The aim of adopting this method is to describe the specificity and complexity of science and engineering master students' perspectives of their advisory relationships.

Participants

Sixteen science and engineering master's students were recruited for this study. All the participants already had academic advisors who primarily served as the students' thesis advisors. These students were enrolled in a research-oriented university which was established in northern Taiwan in 1956. The student population is 12,362, of which, 3,890 are master's students and 2,328 are doctoral students. Out of the 16 study participants, 10 were males and 6 were females; their ages ranged from 21 to 26, with an average age of 23.85. Six of them were in the College of Engineering, 4 were in the College of Life Science, 3 were in the College of Science, and 3 were in the College of Nuclear Science.

Researchers

Both researchers have had the opportunity to advise both graduate and undergraduate students. This has given them first-hand experience with the often inscrutable relationship between advisor and advisee. The first author of this study observed a power differential between advisors and advisees, particularly in graduate schools. Having worked extensively with graduate students, particularly in supervising their theses and training them to be research and teaching assistants, the second author observed an often-occurring discrepancy between the expectations of advisors and advisees. Both researchers recognized that graduate students suffer from a high degree of stress, and need assistance to learn and develop effectively over the course of their graduate studies.

Data Collection

A research assistant (RA), with a master's degree in counselling, conducted 16 interviews for this study. The RA had completed courses in interviewing skills, counselling, qualitative research, and research methodology. She also received training from the researchers and conducted several pilot studies to refine her interviewing skills. During the interviews, the RA worked toward establishing trusting relationships with the participants and maintained an open and non-judgmental manner.

The 16 participants were recruited using a snowball method: the RA invited the first participant, who had already been working with his advisor on a thesis, to join the study. The first participant referred the next participant to the RA, and that one to the next. The RA contacted the prospective participants by phone, e-mail, or letter to schedule appointments. Each participant was asked to read and sign an informed-consent letter before being interviewed.

Sixteen in-depth interviews, which were conducted within a one-month time frame, comprised the principal data for this study. Each interview, which was semi-structured and consisted of broad, general, and open-ended questions, lasted for 90-120 minutes and focused on a variety of areas related to their relationship with their advisor. The use of open-ended questions allowed the researchers to gather qualitative information from the students. Initial questions delved into whether the graduate students were assigned to or chose to work with their current advisors, and the length of time they had worked with their current advisors. All participants were encouraged to describe as completely, clearly, and concretely as they could their perspectives and their 'lived' experiences of the phenomenon over the course of their graduate studies. Guiding questions for this interview included the following: (1) Please describe the relationship between your advisor and you. (2) What roles does your advisor play in this relationship? (3) What do you expect from your advisor? (4) How satisfied are you with the relationship with your advisor? (5) What does a good advisor mean for you?

Data Analysis

The first author conducted the data analysis of the transcribed interviews by following a modified pattern outlined by Giorgi (1985). The analyst bracketed off her assumptions about the advisor-advisee relationship and suspended her existing attitude toward the advisor-advisee relationship, in the search of new and underlying meanings. Before analysis commenced, the first researcher obtained a sense of each complete interview within its context by reading the transcripts several times. Second, the analyst read the transcripts and defined relevant and psychologically explicit meaning units. Next, she integrated meaning units and organized data within a logical and contextual relationship. Fourth, she articulated the meaning units by translating the participants' descriptions of their experiences into psychologically relevant meanings based on their advisory experiences; these meanings were then put into terminology that expressed them in more direct language. Finally, the analyst built the situated meaning structure and

integrated it into a narrative retelling of the events which revealed a meaningful description of the participants' advisory experiences.

The analyst also utilized dependability strategies proposed by Gibbs (2007). She documented the steps of the procedures, set up a detailed protocol and database, checked the transcripts to ensure accuracy during transcription, constantly compared the data with the codes, and made notations about the codes and their definitions. The analyst also used credibility strategies proposed by Creswell and Miller (2000). First, she triangulated different data sources by examining evidence from the sources and using it to construct a coherent justification for themes. Next, she adopted member-checking to determine the accuracy of the findings. In the third step, she used rich descriptions to express the findings and demonstrate the setting. Fourth, she used self-reflection to create an open and honest narrative and to contemplate how the interpretation of the findings might have been shaped by her own background. In summary, the analyst spent a prolonged period of time in the field, developing an in-depth understanding of the phenomenon and conveying details about the sites and the people, which lent credibility to the narrative account.

Results

Participants recognized the importance of the advisory relationship. Three major themes emerged from data analysis: roles and functions of an advisor, choosing an advisor, and interaction between advisors and advisees. Themes and sub-themes are elaborated below, illustrated with quotes from the participants.

Roles and Functions of a Mentor/Advisor

Participants perceived mentors/advisors as playing multiple roles and performing various functions for the advisee, including that of a professor, instructor, thesis advisor, employer, standard-setter, administrator, and helper. They thought that their advisors should provide proper, need-based assistance at various phases of their instruction. Participants expressed their need for clear guidance when they first entered the graduate programme. They emphasized that guidance during their first phase of the graduate programme should cover skill-training, professional consultation, curriculum guidance, periodical reading, lab participation, lab facility orientation, and lab team formation. At this stage, participants expected their advisors to provide instruction in the rules and regulations of the graduate school and labs, curricula, and research topic exploration. Briefly, the advisor should be both an institutional and a professional authority during the initial phase of graduate students' education. As one student reported,

"At first, I knew nothing about graduate study, so I really needed guidance and assistance from my advisor to help with the required courses and credits. My advisor then asked me to work in the lab. He really is my mentor and a professional authority."

During the middle phases, participants served as assistants to their advisors, with responsibilities for teaching, overseeing experiments, and completing administrative duties. They generally regarded their advisors as employers as well as directors and managers of the lab. During the latter phases of graduate school, participants became familiar with the process and management of research and regularly discussed the research results with their advisors. In this stage, the advisors ensured that the master's students knew and met the criteria for graduation. A student said, "My lab experiment is now coming to an end, so I will show my thesis draft to my advisor." He continued, "After all, he is the person who can decide whether I can graduate. He will advise me on the graduation criteria, and then I can set a timetable and goals accordingly."

In the last stage, participants, who were finishing their theses and ending their roles as teaching or administrative assistants, often regarded their advisors as life mentors. They tended to discuss future careers and employment with their advisors. To sum up, as students progressed through the different academic phases, their expectations of their advisors changed.

Choosing an Advisor

Participants claimed that advisors should be compatible, professional, and have a pleasant personality. The majority of the participants chose their advisors once they entered the programme. They mostly selected professors who were in a similar research field, and they were more likely to pick advisors with professional competence, a desired personality, and concern about students. They also tended to choose advisors who had learning attitudes and values similar to their own. "I chose my advisor mainly because I am interested in his research field; plus he is a nice person," said one student:

"He does not have many students, so I can meet with him weekly. Although meeting with my advisor is quite stressful, I can learn professional knowledge from him. I really want to learn things from my advisor instead of just messing around and getting a degree."

The expectations of the master's students were often quite different from the reality. Participants believed that an ideal advisor should possess good professional knowledge, facilitate the team spirit of the lab, and assist students in exploring their research interests. They also believed that the perfect advisor should comply with the professional code of ethics; respect the research results of students; treat students fairly; allow enough time for research; adjust the guidance style to the students' capabilities; take the initiative to enquire into the students' academic learning, life, and career development; and provide help when necessary. In reality, participants realized that advisors were often busy, and thus, were unable to devote sufficient time and energy to guide them.

As well, some students revealed that their advisors lacked professional capabilities and/or were poor in communication skills; some said their advisors confused them by constantly changing the direction, procedures, or standards of lab research. As much as participants expected certain things from their advisors, they acknowledged the gap between the ideal and reality. To bridge this gap, these students sought help from others. They turned to peer mentors among the doctoral and senior graduate students. Therefore, though their faculty mentors played the key role in their master's careers, the peer mentors provided support when the advisor was unavailable or unable to fulfil the master's students' expectations and needs.

Interaction between Advisors and Advisees

Participants pointed out that it is a Taiwanese tradition to respect teachers. Professors are authoritative; professors and students are not equal in the hierarchy. Therefore, it is difficult for students to express their opinions or to ask their mentors/advisors to change either their communication style or methods of leadership and guidance. Most students tended to be compliant and accepting. Since participants rarely thought of changing advisors if disagreements or conflicts arose, they adjusted their own thoughts and expectations instead. "I think my professor is too old to change his way of doing things. Since he has the power to decide who can graduate and who cannot, I think it's easier and better for me to adjust myself," sighed one student.

Next, participants shared that conflicts between advisors and students usually happened when advisors were dissatisfied with students' academic performance. Mentors and students often did not have comparable expectations about the outcome of lab research, and they and their mentees often had different views on the allocation of research credit and graduation standards. Moreover, some students believed that their advisors were biased for or against certain students, perhaps because the graduate students had different personalities, values, or ways of doing things from that of their advisors.

When students had conflicts with their advisors, the majority would adjust their own attitudes and behaviour to meet the expectations and demands of their mentors. They would consult with senior peers to learn more about their advisors' personality, style, and standards. Then, they would make adjustments accordingly. Participants also sought help from senior students to gain supervision, support and assistance when they found out advisors might not provide enough or effective instruction to them. Some would air their grievances with peers or leave their labs for a short period of time to release tension. The majority of participants did their best to resolve problems, adjust emotions, and conquer stress and obstacles resulting from negative interactions with their mentors. One stated:

"I would adapt to the environment of graduate school and lab and think of a way to survive. ...Sometimes, I would talk to my lab mates to get it off my chest or play ball or go shopping to ease my anxiety. I would go back to my lab when I felt better."

Aside from dealing with conflicts, other problems the students identified had more to do with how their advisors did or did not relate to them. Some participants expressed dissatisfaction when mentors did not care about students or did not provide sufficient instructions. Others commented their advisors were poor in communication skills and often criticized students harshly. Some felt that advisors were unfair to students or set standards way too high. Some advisors did not clearly communicate their standards or often revised their standards. Other mentors were too utilitarian, serious, or indifferent. All of the above situations made students frustrated and caused negative interactions between them and their advisors. "My advisor is quite emotional," noted a student:

"He would harshly criticize students' reports...When I was in my first year of graduate study, I felt tension between the advisor and the students. I was always fearful at the time ... Sometimes I spent a lot of time exploring possible research approaches, but my advisor was not satisfied with my research results, and he would criticize my results harshly. It felt incredibly painful."

Some participants suggested that vice or assistant advisors should be supplemental to the advisory system of graduate schools in the fields of science and engineering in Taiwan. Under the onus of traditional authority and the hierarchical culture of science and engineering graduate schools, students tended not to actively communicate with their own advisors and were less likely to seek help from other professors. If graduate schools had the formal position of 'vice-advisor', graduate students could benefit not only from their advisors, but also from their vice-advisors. According to the participants, the vice-advisor could play a role in offering psychosocial support to assist students in coping with stress, especially when advisees had conflicts with advisors.

In summary, science and engineering graduate students thought that their mentors should play different roles and perform different functions, depending on students' needs in the different phases of the students' education. As a result, they tended to choose advisors who were compatible with them and who were professional and personable. They believed that ideal advisors should be professional, comply with the professional code of ethics, care about students, and provide enthusiastic guidance. Students recognized that there would be gaps between the ideal and reality and that the authoritative culture of science and engineering graduate schools affected their interaction with advisors; therefore, most of them did their best to make adjustments.

Discussion

Agreeing with the findings of existing western studies, this study showed that Taiwanese science and engineering master's students recognized the importance of advisors in helping them complete their graduate programme and making academic progress. Advisors serve as mentors who play an essential role

in the personal (Stafford & Robbins, 1991) and professional development of graduate students (Schlosser et al., 2003). They also promote the professional productivity of their advisees and foster their confidence in their abilities and enthusiasm for the field (Knox & McGovern, 1988).

According to these participants, at the beginning of the master's programme, mentors/advisors are expected to serve as professional role models, explain the programme and laboratory regulations, and help students integrate with the research team. Then, advisors guide students in research and in the last stage, they help them to meet their graduation requirements through clear communication, thus enabling students to efficiently manage their time in order to achieve their goals. By graduation time, the advisors often become the students' life mentors and partners on an equal basis.

Students, in general, expect advisors to meet their developmental needs over the course of their study in graduate school. As Noonan, et al. (2007) claimed, effective mentoring (advising) must be tailored to the appropriate developmental needs of the mentee and should progress from a basic to a more advanced level. Likewise, the mentor, as suggested by Brown et al. (2009), should be aware of the students' developmental needs and should select an appropriate approach for their mentoring.

Generally speaking, participants in this study expected advisors to play different roles and carry out various functions (mainly psychosocial and instrumental) in their education. The results echoed Kram's (1985) ideas on working with mentees; that is, mentors engage in various roles to provide psychosocial and career functions. Advisors' mentorship incorporates a wide range of roles (Johnson, 2002) and provide students with knowledge, advice, challenges, counsel, and support in the advisee's pursuit of membership in a particular profession (Clark et al., 2000). Advisors pass on knowledge and experience, provide support and consultation, and serve as spiritual guides to students (Chien, 2009; Wang, 2006). Next, to maintain a harmonious relationship with advisors and maximize the value of a positive advisory relationship (Chen, 2006; Lee, 2010), particularly in an environment that emphasizes authority and respect for cultural hierarchy, advisees follow advisors' guidance, suggestions, and instructions in study and research; they also make adjustments to cope with stress and to solve problems to meet the criteria set by the advisor.

This study confirms that mentors promote the professional productivity of their students and foster students' confidence in their abilities and enthusiasm for the field (Knox & McGovern, 1988). The study results also echo previous findings that effective mentors are ethical (Kitchener, 1992), psychologically well-adjusted (Cronan-Hillix et al, 1986), intentional role models (Gilbert, 1985), who are interpersonally supportive, encouraging, poised, kind, healthy, and competent (Johnson, 2002). Additionally, advisors are expected to provide social and financial support and consultation (Liu, 2007), help students adapt to the role of graduate student (Johnson & Huwe, 2002), familiarise students with professional norms and

programme requirements (Golde, 2000), and assist students in professional socialisation (Weidman et al., 2001).

Corresponding to Chien's (2009) findings that learning outcomes improve when advisors and advisees have common values, characteristics, and decision styles, this study showed that a well-matched advisor-advisee positively correlates with a student's psychosocial functions, interpersonal network, and satisfaction with the advisor. In contrast, if the needs of mentors and mentees are incongruous, or if one or both members are unable to meet the primary needs of the other, the mentorship is likely to suffer (Johnson & Huwe, 2002).

Despite the many positive comments from participants, a few of those in this study were not satisfied with their advisors. They viewed their advisors as incompetent, unable to properly advise students, unfair or unavailable to them, and/or unable to set realistic academic goals. Some advisors caused conflict with students through sharp expressions or an inappropriate attitude; other advisors did not clearly express their expectations for students' academic performance. As discussed by Clark et al. (2000), poor mentorship includes mentor unavailability, unreasonable expectations on the part of the mentor, or negative mentor personality traits or behaviours.

Students in this study adapted themselves, reduced pressure, and worked hard to meet advisors' expectations to accomplish assigned teaching, administrative, and/or research work. Even when participants had conflicts with their advisors, they seldom expressed their views to their advisors, fought for their rights, or asked advisors to change their advising style. Even when they were dissatisfied with their mentor, they endured their advisor's authority and the hierarchical culture of graduate school, and mentees rarely put forth their views. Students adhering to the traditional Taiwanese culture of respecting teachers and the authoritative, hierarchical culture in the science and engineering fields tried to accept advisors that they were not satisfied with or with whom they had constant conflicts. Surrendering their power and control to the advisor (Han, 2009; Kuo, 2004), these students, just like the students in Lin's study (2011), rarely changed advisors. Instead, these students would do their best to modify their attitudes, expectations, and behaviours to cope with the stress caused by advisor-advisee incongruence. For example, when advisors were too busy to contact advisees or provide instruction, advisees turned to peer mentors for help; these peer mentors were mostly senior doctoral students in the same lab or graduate school.

This study's results reveal that science and engineering graduate students are in an authoritative, hierarchical, male-value-oriented and patriarchal learning environment. Perceiving themselves to be at the bottom of the power structure, master's students tend to follow advisors' orders and research instructions. They fear expressing their needs and unhappiness since they believe their graduation is controlled by their

advisors. It is easier for them to make adjustments than to hope their advisors would make changes for them. Advisor-advisee interaction, therefore, is unequal, and the communication is top-down. To mitigate the stress from such a gap, the utilization of peer mentors who may provide emotional support could be encouraged.

In addition to adjustments on the part of mentees, mentors can also play a role in facilitating more successful interactions. Advisors could first be aware of how the power differential influences advisor-advisee relationship and advisees' learning. Then adjust their attitude toward advisees, listen to and understand learning and research problems, and provide appropriate assistance. Furthermore, university authorities could provide workshops that train advisor on skills such as listening, empathy, communication and supervision. Also, advisors with a solid reputation for excellent supervision could be taking on the additional mentoring role of being a mentor to novice advisors. Another practical solution would be for university authorities to reduce the number of advisees assigned to each advisor. This would ensure that each advisor would have more quality time with each advisee. To make the advisory system even more comprehensive, a vice-advisor system where advisees can turn when their advisor is busy or unable to provide sufficient help could be established.

Another issue is to develop a counselling system, which can help students choose an appropriate advisor by contemplating their needs, prospective advisor's expectations, and the regulations of research teams and labs. A complement to this system would be a reasonable advisor changing system. When there is a serious, unresolvable conflict between advisors and advisees, advisors could respect and help advisees and refer them to counsellors. Counsellors may help students weigh the benefits of changing advisors and coping with any consequences from changing advisors. Ultimately, university authorities are responsible for diminishing the hierarchal and patriarchal systems in graduate schools and building a learning environment that respects students' learning needs and can foster young scholars.

Implications

Theory. The relationship between advisors and advisees in graduate schools could be constructed as a developmentally dynamic process. In addition to considering the characteristics of both parties, it is crucial to evaluate the degree of congruence (e.g., expectations, competence, learning and/or instruction style, values and needs) between advisors and advisees.

Practice. Taiwanese science and engineering master's students emphasized that students should carefully choose advisors who have similar research interests, compatible personality traits, and learning attitudes; they should clarify advisors' values and expectations and the criteria and requirements of academic work. In addition to considering factors, such as an advisor's professionalism, research interests, academic ethics, personal characteristics, attitude, values, and expectations, master's students are urged to

consider whether a potential advisor would complement their needs. Ideal advisors should respond to advisees' developmental status, value mentor-protégé interaction, satisfy students' needs, and assist students in solving academic and life problems.

Additionally, advisors should explain the expectations of advisees in research and help them meet the final objectives of their programmes to graduate and establish a career. When a mentor and mentee cannot complement each other in terms of research interests, personality traits, behavioural patterns, and learning styles, instead of allowing constant conflicts and an impaired advisory relationship to continue, this study suggests an advisor should support their advisee's search for an alternative advisor.

Research. Further research might examine the process of selecting advisors and advisor-advisee matching in order to facilitate a better system for promoting a positive advisory relationship and to ensure a productive advisory experience. Researchers could further investigate the impact of cultural and contextual factors on the establishment of the mentoring relationship and the implementation of mentoring practice in graduate schools.

In summary, a good understanding of what qualities ideal/effective advisors should possess seems to be necessary for new students enrolled in graduate schools. A decrease in authority, power differential, and hierarchical differences between advisors and advisees might bring about closer interaction and enhance the quality of the advisory relationship. Moreover, a vice-advisor could be established to improve the traditional one-to-one advisory system and ease conflicts between advisors and advisees.

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