Specific practice of the *Last Mile* project at Taiwanese universities of science and technology: the *topping* course

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ABSTRACT: The so-called *Last Mile* project aims to help industry to find suitable professionals and to help students prepare for their future careers. In order to achieve these two objectives, the academic sector has to focus on two areas. Firstly, the requirements of industry should be considered in curriculum design for the last academic year at universities. Secondly, the myth that the graduates of Taiwanese universities of science and technology are less capable needs to be addressed. Therefore, in this article, the authors introduce a *topping* course to replace the *sandwich* course. The authors advocate two arguments. First, they are concerned about how to narrow the gap between *learning* and *practice*. In addition to involving the needs of industry in curriculum design, the purpose of a *topping* course is to help students employ what they learnt into practice so as to narrow the gap between theory and practice. Also considered here is the myth of students' abilities. The opportunities in internships should be provided in the last semester so that potential employees are able to evaluate interns for future employment. The topping course is expected to meet the ideal of *being employed after graduation*. It is likely to be specific practice of the Last Mile advocated by academia and industry.

INTRODUCTION

Background and Rationale

The so-called *Last Mile* project has been one of the most popular topics that has been widely discussed among government, industry and academia. The Council of Labor Affairs of Executive Yuan promotes *employment training schemes in Taiwanese universities and technological universities and colleges* [1]. As such, the Ministry of Education administers the Last Mile project [2].

Both government and academia seem to have taken the proposal of the Last Mile as provided by Mr Sayling Wen, former Vice-President of Inventec Corporation. The Last Mile project offers new courses on the basis of the requirements of academia and industry. It is doubtful whether the new courses requested by academia and industry can bridge the gap of the Last Mile. The authors seek to explore room for improvement.

In addition to restating Mr Sayling Wen's concern, the authors also try to explore the merits behind the common opinion that graduates from universities of science and technology in Taiwan are less competent [3]. This research emphasises that, in order to execute Last Mile in the universities of science and technology, a so-called *topping* course, plus specialised courses needed by industry, should be offered. For the industry sector, a topping course can help lower the expenses of recruitment, shorten probation periods and facilitate the recruitment of competent employees. For students, a *topping* course can help them to become familiar with possible workplaces, and psychologically and physically get them ready for entering into job markets. Most importantly, interns are likely to be hired right after graduation by the same employers. By doing so, the influence of school rankings may be reduced [4].

Aims and Research Methods of the Study

Aims of the Study

Internship has long been included in curricula of the universities of science and technology, especially the so-called *sandwich* courses. However, the industry sector has discovered that there is an obvious gap between the objectives of sandwich courses and industry needs in workplaces. In order to bridge this gap, two aims of *topping* course are discussed in this article, as follows:

- To find out the differences between sandwich courses and the Last Mile;
- To propose a *topping* course in order to foster collaboration between academia and industry for the Last Mile project.

Research Methods and Procedures

In this article, the authors seek to review whether teaching practices are more likely to meet the core value of the Last Mile. The sandwich course involves several kinds of partnerships with slightly different relationships. By reviewing literature, the definition and contents of sandwich courses have first been analysed, continued with an elaboration of the *topping* course, followed by comparisons of the sandwich course, the topping course and the Last Mile. The article ends with conclusions.

SANDWICH COURSES AND PARTNERSHIP APPROACH

Sandwich courses, the forerunner of academia-industry collaboration, were first launched in Scotland in 1880. After being discussed between academia and industry for nearly one century, and influenced by social transformation, the principles

and contents of a sandwich course remain the same. The main objective is to equip students with the skills needed in industry before graduation.

In fact, any form of education is intended to help students to put what they learnt into practice, which is the essence of education [5][6]. In particular, technological and vocational education should make good use of the partnership approach in order to train professionals for all walks of life.

The partnership approach has been widely used in Taiwan and broadly defined as the collaboration between academia and industry [7-10]. On the basis of students' career plans, the academic sector cooperates with industry and offers preparatory courses to familiarise students with professional knowledge and skills. The following are the five values for this type of training:

- The value of the academic;
- The value of career development;
- The value of the economy;
- The value of individual maturity;
- The value of social awareness [10].

According to Mason and Haines, the above five values can be carried out in the five programmes as follows:

- Cooperative education;
- Work-study;
- Internship;
- Work experience;
- Work observation [10].

The sandwich course, the predecessor of the partnership approach, almost covers the above programmes.

Students engaged in a sandwich course have classes in school and work in actual workplaces at intervals until they complete the programme. The aim of this course is to integrate theories with practical experience [9]. Therefore, it is also called a *rotation system* [11].

Sandwich courses were introduced and accepted in higher education after World War Two [10]. In Taiwan, Kaohsiung Hospitality College was the first college to provide a sandwich course, which was designed to foster collaboration with Swiss hospitality schools. In the first semester, students study in schools and in the second semester, they serve as interns in industry. Further, they have to join a three-week overseas field trip before graduation in order to reinforce professional knowledge and skills [12].

A review of relevant literature has been undertaken [13-15]. The background and objectives of the sandwich course are described as follows:

- *To put theory into practice*: Foundation courses and general education courses, including in the curricula at universities, are unable to equip students with practical skills they need in job situations. In order to help students become ready for their future careers, sandwich courses are designed to cooperate with industry and provide opportunities for students to have hands-on experience;
- *To increase job opportunities*: Students who possess good attitudes, morals and professional knowledge are more likely to be hired by those employers that are involved in sandwich courses. This is another benefit for those students who take a sandwich course;
- *To improve students' interpersonal relationships*: The academic environment is relatively simple compared with the industrial one. Generally, students have few chances to be involved with industry, but most have contacts with their classmates, teachers and parents. In sandwich courses, students become involved with more people from all walks of life and learn how to interact with others, as well as how to develop understanding and mature further;
- *To lower the cost of laboratory teaching*: Due to tight budgets, the academic sector is usually unable to purchase equipment that meets the changing requirements of industry. Through the partnership approach, students can gain hands-on experience and the academic sector can save money on expensive laboratory equipment.

In sandwich courses, reciprocal agreements are the highest principle for maintaining sustainable collaboration between employers, schools and students. By cooperating with schools, employers can enhance current employees' morale, skills and competence levels. During the period of internship, employers may also cultivate potential employees' morals and then select those who have adapted to company culture. In other words, sandwich courses may help employers to recruit, train, place and keep employees.

For the academic sector, schools may fully integrate resources both on-campus and off-campus in order to increase the efficiency of education and reduce the burden on the education budget. In addition, schools may develop their characteristics and differentiate themselves from their counterparts. For students in sandwich courses, they may apply what they learn in schools into practice and prepare for their chosen careers. However, according to Brewer, Ascher and McCain, plus some related literature, sandwich courses now face the following challenges:

- It is getting more difficult to arrange a workplace for students;
- The traditional curricula no longer meet the needs of workplaces;
- There are few competent and qualified teachers from job markets;
- Students are not willing to take part in the course;
- It is not easy to receive administrative support [16-18].

The first point is due to the popularity of high technology, particularly in the manufacturing industry, in which automatic production lines have taken the places of workers. Fewer and fewer companies are interested in participating in sandwich courses. This remains the biggest problem affecting sandwich courses, unless schools can offer comparable benefits to industry [19].

DEFINITION OF THE LAST MILE

The Last Mile originates from the telecommunications industry. It refers to the portion of the cable or telephone company that is wired into the customer's home. This portion is the most difficult part to construct. The academic sector has since redefined it as the last year programme at universities of science and technology. The programme, a new path to cooperation and partnership between academia and industry, seeks to equip students with the skills they need right after they move into job environments [20].

The Last Mile was coined in Jason Wolf and Natalie Zee's book, *The Last Mile: Broadband and Next Internet Revolution* [21]. They argued that the speed of broadband, the latest technology, would be much faster than that of the traditional modem. The Internet would not remain as a kind of linear communication, but more an interactive and instant one. Industry had to take advantage of broadband and the Internet so as to be more productive and competitive.

This idea later affected problem-solving and the revolution in the education system. Because of the inadequate competences possessed by graduates from universities of science and technology, as well as the gap between learning and practice, most students would be jobless after graduation. In order to lower the unemployment rate, the Ministry of Education administers the Last Mile project, which targets the promotion of collaboration between academia and industry in designing curricula for students' last year at universities of science and technology. In fact, the spirit of the Last Mile has also been included in the partnership schemes promoted by the Ministry of Education. A distinction between the Last Mile and partnership schemes can be drawn. The Last Mile emphasises last year courses, which must meet the requirements of industry.

Nevertheless, some people question the aim of the Last Mile. The purpose of higher education should be liberal or for specific purposes. If the curricula are tailored to the needs of industry, schools will become a job training centre. However, industry is willing to join the Last Mile project to reduce the cost of orientation and training. From the perspective of the long-term development of technological and vocational education, the Last Mile project is worth trying, but the essence of technological and vocational education – to develop students' potential – should be focused on, rather than catering to the needs of industry profits, usefulness and high-speed. Otherwise, the functions of a technological and vocational education will be distorted and the spirit will be lost [22].

The aforementioned Last Mile in telecommunications refers to the portion of the cable from a control room to customers' homes. In the academic sector, it relates to the last year programme at universities of science and technology. However, does the Last Mile project help to narrow the gap between students' competences and the demands of industry? The following are the results of a CHEERS' survey in anticipation of the job markets in 2004:

- 64.6% of companies take account of an applicant's *alma mater*, while few of them (7.1%) do not consider the student's school ranking.
- Less than half of the companies surveyed took applicants' transcripts into consideration. This may be because evaluation methods are different across schools and the school ranking is more important for the fact that most companies believe that graduates from higher-ranked schools are better than those from lower ranks. If this is the case, it can be concluded that an applicant's academic performance is relatively less important than his/her *alma mater*.
- 47.2% of companies emphasised a school's reputation, while 33.1% of companies recruited only graduates from national universities. Notably, only 7.9% of companies, particularly in the field of engineering, employed graduates from universities of technology [3].

The above study shows that graduates from technological and vocational universities are stereotyped as less capable employees. Although the Last Mile project is intended to narrow the gap between students' competences and the needs of industry, this myth is much more difficult to disentangle. Some companies group job applicants according to their educational background. Graduates from private vocational colleges are excluded at the very start [23][24]. This reality has not been mentioned and considered in the Last Mile project, but it is definitely worthy of attention in academia and industry.

INVOLVING THE TOPPING COURSE IN CURRICULUM

Definition of a Topping Course

The term *topping* is related to sandwich courses. In April 2004, *topping* first appeared in conferences on curriculum design for management colleges held by Shu-Te University. The conference, *Modular Curriculum and Topping Courses*, invited professionals from industry to take part in designing course contents. In December of the same year, the term *topping* was formally used in the academic field in the conference, *Development of Higher Education and Collaboration between Academia and Industry* [4].

The original meaning of topping refers to ingredients on the dough of pizza. It is the last step in making a pizza, which makes topping different from the stuffing in a sandwich [4]. The sandwich course originated in Scotland. Since it was introduced to education, it has been carried out using various methods in different countries, but the main idea has been the same: the aim is to provide opportunities for students to digest and apply what they learn into practice. Meanwhile, students may learn more in practice and improve their skills [13].

Topping is a brand-new term in education. Some may argue that it is similar to the last-year medical or nursing practice in medical schools or teaching practice in normal colleges and universities. However, there are some distinctions to be made. The authors point out two objectives in a topping course. First, to narrow the gap between course objectives and those competences needed by industry. Second, to disentangle the myth of grouping job applicants on the basis of their educational background.

The objectives of the topping course are obviously consistent with those of the sandwich course, but their administrative methods are different. The authors believe that the sandwich course is driven from academic needs to try to combine theory and practice. In contrast, the topping course is developed to meet the requirements of industry and to weaken the influence of the myth that graduates of universities of science and technology are less capable.

Contents of a Topping Course

In order to build up the Last Mile between academia and industry, the authorities, academia and industry are eager to make policies on, and allocate more budgets for, the Last Mile. Particularly at universities of science of technology, more vocational courses have been offered over the last year to prepare students for job markets [25]. In addition, responding to Mr Sayling Wen's request for the Last Mile, the authors argue that the meaning of the Last Mile is to integrate learning and practice so as to gain employment after graduation.

Generally speaking, the basic requirement of industry is that students have learned the skills they need in schools. Additionally, students have to face the reality of being grouped according to their various educational backgrounds. Those who have graduated from low-ranked schools may not be granted an interview when a company recruits new and, especially, few employees. If this is the case, those competent graduates from low-ranked schools will not be employed. In particular, graduates from universities of science and technology have long been discriminated against in the job market [26].

The objectives of the topping course the authors propose in this article are consistent with those of sandwich courses. However, since the administrative methods of these two are different, the rationales are worthy of more discussion.

In the literature on sandwich courses, four benefits have been identified, as follows:

- Integrating theory into practice;
- Offering more employment opportunities;
- Improving students' interpersonal relationships;
- Reducing the cost of education [15].

The above benefits are also the objectives of the sandwich course and the topping course. Their different rationales are explained in the next section.

Integrating Theory into Practice

It is believed that sandwich courses in most curricula at schools are foundation and general education courses that cannot equip students with the relevant skills needed in the workplace. Therefore, students may verify their knowledge in real situations in sandwich courses. It is viewed that topping courses in most curricula on campus are the foundations of knowledge. How students apply themselves in the workplace depends upon the design of practical courses [9]. More importantly, practical courses should be designed for those future workplaces chosen by students [27]. Students from a management college, for example, need to take courses on work ethics and attitudes, as well as customer service.

Practical courses should be offered after foundation courses [28]. After students acquire sufficient knowledge, they are more likely to be well trained for the workplace. Obviously, the timing of the practical course in a sandwich course is too early, while the topping course places them after all the foundation courses, and they are further evolved to suit the needs of industry. Before the first semester of the last year, students have to take all the foundation courses required by strategic alliances and partners of the university. In the second semester of the last year, students, as interns, learn and work in real workplaces.

Offering More Employment Opportunities

Employers may observe students' performance in the workplace. Those with good work ethics and professional knowledge are likely to be hired after graduation. By contrast, those students who join a sandwich course have to go back to school to finish other courses. Employers seldom keep vacancies for these competent interns. Furthermore, in this current highly competitive society, what students learn in a sandwich course may be out-of-date after they graduate half or one year later.

Intern students enrolled in topping courses are relatively more motivated because they may be hired by their employers before graduation [29]. From the perspective of employers, they are more willing to train students who perform well and can be recruited, and they are less likely to treat students as a cheap labour source [26][30]. Thus, topping courses are more welcomed by industry and increase the job opportunities available for students.

Improving Students' Interpersonal Relationships

It is a common belief about sandwich course that students have few chances to be interact with industry, but mostly have contacts with their classmates, teachers and parents. However, in sandwich courses, students may become involved with professionals and customers and learn how to interact with each other.

It is assumed in topping courses that improving students' interpersonal relationships involves the development of gregariousness and socialisation. Indeed, socialisation development prior to gregariousness development makes for a better distinction compared to the other way round. As far as schooling is concerned, extracurricular activities, such as clubs and societies, may serve as a good place for students to develop their interpersonal relationships [31]. This ability is of importance for low- and middle-class managers to coordinate matters intra- or inter-departmentally [32].

Generally, freshmen, sophomore or junior may take part in sandwich courses [11]. In terms of timing, the psychological and physical development of freshmen and sophomores means that they are not yet ready for industrial activities. Junior students, with their more mature development and experience in extracurricular activities, may be able to adapt to social activities in their workplaces. Students in topping course are all senior. Their psychological and physical conditions are likely to make them ready to interact with employers, customers and one another.

Reducing the Cost of Education

Practice courses in early technological and vocational education are usually held in factories, stores or banks on campus [33]. Currently, in the field of hospitality and catering, many schools provide internship opportunities in on-campus restaurants. This internship system is excellent for lower-grade students. However, such places should not be confined to sites on campus, which may often be a protected market.

Unlike restaurants, factories or stores have to be set up with high costs. Without constant investment, equipment, decorations or managerial procedures, they will soon become old-fashioned, especially when compared with other companies. Apparently, to reduce the cost of facilities associated with internship, off-campus internship can replace the on-campus form [10].

Recently, it has become more difficult to find a suitable company for internship as industrial structures keeps changing and more industries move out from the island. Furthermore, in the highly-competitive society, it is understandable that companies are unwilling to provide a formal orientation for students who have to go back to school to finish their education [17]. In contrast to this situation, companies are more willing to train possible future employees engaged in a topping course. By doing so, schools may reduce the cost of practical teaching and maintain the quality of internship courses.

In short, the topping course aims to realise the maximum level of efficiency of internship and achieve the ideal of getting employed after graduation. The focus is on whether or not graduates of universities of technology are able to meet the labour needs in industry, as well as on disentangling the myth that graduates from universities of technology are less capable in the workplace.

DISTINCTIONS BETWEEN *TOPPING* COURSE AND SANDWICH COURSES

According to the literature, sandwich courses aim to integrate theory into practical experience. The background and methodologies are different worldwide due to different education systems, but they all share one similarity. Students are required to *learn in practice* and *practice to learn* in rotation so as to develop the skills needed by industry.

As mentioned before, there are four benefits of sandwich courses, namely: putting theory into practice; increasing students' employment opportunities; improving students' interpersonal relationships and reducing the cost of education. This course has long been administered in Europe and America. In Taiwan, Li Fu-den first included sandwich courses in the curriculum at Kaohsiung Hospitality College [13].

The topping course has actually been carried out at normal universities or colleges and medical universities, but the term *topping* used in this article is slightly different in the meaning and contents. A topping course is particularly developed for a Last Mile project. In addition to including the needs of industry into curriculum, a topping course takes the myth of less-competent graduates into consideration.

In topping courses, students have to be psychologically and physically ready, and be equipped with a foundation knowledge before they can apply theory into practice. Industry needs can then be considered in the curriculum design. Finally, the effectiveness of the topping course may be evaluated in students' practice. A topping course is not compulsory, but is only for those who plan to enter the job market after graduation. The objectives of topping courses and sandwich courses are the same, but they have different rationales. Table 1 summarises the main distinctions between them.

Table 1 lists the distinctions between sandwich courses and topping courses in terms of establishment time, rationale, methodology, objectives and methods. Whether or not a topping course can achieve the aims of the Last Mile is discussed in the next section.

RESULTS AND DISCUSSION: COMPATIBILITY BETWEEN TOPPING COURSES AND THE LAST MILE

By reviewing available literature, the Last Mile project proposes to narrow the gap between *learning* and *practice*, and to equip graduates with the skills needed in the workplace. As per the survey, when recruiting, employers group job applicants according to their respective educational backgrounds. This practice is obviously another Last Mile for graduates of universities of technology.

To narrow the gap between *learning* and *practice* and, at the same time, to disentangle the myth of *grouping according to competence*, two points below are taken to argue that the *topping* course is one of the specific practices of the Last Mile.

Table 1: Comparison between topping and sandwich courses.

Difference/ Teaching Mode		Sandwich Course	Topping Course
Establishment time		Began in 1880 in Scotland Began in 1987 at Kaohsiung Hospitality College by Li Fu-den.	First introduced in April 2004 in a seminar at Shu-Te University.
Rationale		Required by academia to reinforce the practical aspect of theory.	In response to the needs of industry and to disentangle the myth of grouping by job applicants' educational backgrounds.
Methodology		Learning in practice, practice to learn.	Includes the needs of industry in the curriculum, students apply their knowledge into practice in real workplaces.
Objectives & Methods	Theory & practice	Provide opportunities for students to have hands-on experience in the workplace.	Arrange intern-ships after all foundation courses and further design training to meet industry needs.
	Increase students' employment opportunities	Introduce distinguished students to employers. But employers are unwilling to orientate students who have to go back to schools to finish their degrees.	Internships can be regarded as the probation period for future employment. Employers are more willing to train graduates.
	Improve students' interpersonal relationships	Provide chances to interact with industry and customers to understand interpersonal relationships.	Develop students' gregariousness first to facilitate their socialisation development.
	Reduce the cost of education	Use operational facilities in industry to save on the cost of on-campus equipment. But many industries have moved off the island and the operational structure has changed a lot.	Face the fact of industrial changes, increasing employers' willingness to train students by arranging internships in good time so that schools can reduce the cost of training facilities and sites.

Narrowing the Gap between Learning and Practice

Including the needs of industry in the curriculum in the last academic year is currently being promoted by the Government, academia and industry [25]. The authors believe that in this research, taking the needs of industry into consideration in curriculum design is a mode of practicing theories and sharing hands-on experience. Even though the knowledge learned in the classroom is based on the needs of industry, some differences still exist between in-class activities and real operations. Therefore, it is necessary for students to take part in internships before graduation. Otherwise, the gap between *learning* and *practice* may be narrowed but would still remain [6].

In topping courses, the competences required by companies, which are representative in a certain industry, should be included in the curriculum. Students who are competent in those courses should have priority to become interns in those companies. These chosen interns are competent to work in companies and are able to apply what they have learnt into practice so that the gap may be narrowed.

The Myth of *Grouping According to Competences*

The educational background has been one of the important standards in recruitment [34]. Recently, there has been a lot debate about *grouping according to competences*. The survey conducted by CHEERS magazine states a cruel fact in workplaces in 2004 in that employers made judgements on the academic ranking of applicants' schools. Indeed, there has been widespread prejudice against graduates from low-ranked universities. Graduates from private universities are sometimes excluded altogether before being given an interview.

In the research described in this article, the topping course tries to improve this situation. Instead of being discriminated after graduation, students have opportunities to be hired if they perform well during internships. An internship period may be taken as a probationary period by employers. In the future, employers can save their expenses for orientation. Furthermore, due to students' excellent performance, students may be hired right after graduation and may be asked to introduce other classmates when companies plan to recruit more employees. Those who cannot be chosen to join internships may have some chances to be interviewed or recruited by the recommendations from chosen interns. The topping course is one method to change the myth of *grouping according to competences* before students enter the job market.

Based on the above two points, a topping course is likely to achieve the aims of the Last Mile and the ideal of *getting employed right after graduation*.

CONCLUSIONS

The motivation for this research is from the proposal of the Last Mile provided by Mr Sayling Wen. The topping course, from the perspective of universities of technology, is designed to innovate practical training in order to realise the objectives of the Last Mile project.

The consensus among the Government, academia and industry is that the needs of industry should be taken into account in curriculum design for the last academic year. In this article, the authors point out that graduates of universities of technology are usually regarded as incompetent applicants because of the noticeable gap between learning and practice. From the stage of course design, the topping course takes into consideration the needs of industry, including general practical knowledge and the specific training required by strategic alliances with universities. Internships of the last academic year offer plenty of time to evaluate interns, who are believed to have more job opportunities than those graduates who do not participate in internships, and may be grouped according to their educational backgrounds.

The objectives of sandwich courses and those of topping courses are very similar, but the contexts and execution methods are different. Sandwich courses originated from early academia to reinforce the practical aspect of theories, while topping courses are designed to meet the competence needs of industry and disentangle the myth of *grouping according to competences*. Although the objectives are consistent, the methods are rather different. The former emphasises the verification of theories in practice, while the latter focuses on the curriculum design for industrial needs after the foundation courses and further strengthens the students' practical knowledge during their internships.

Sandwich courses seek to verify theories in practice, but the foundation knowledge is not mentioned at all. In contrast, topping courses incorporate the needs of industry in the last academic year and then provide internship opportunities for students. It is concluded that the topping course is likely to be a specific practice of the Last Mile. However, whether or not sandwich courses or topping courses can achieve the objectives of the Last Mile has not yet been researched in sufficient depth to support the two points described in this article. Further research is in progress to find out the distinctions in practice between sandwich courses and topping courses from the perspectives of academia and industry.

As detailed in this research article, the topping course is expected to gain more attention from the Government, academia and industry, and should encourage innovation in training courses.

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