



# Journal of Applied Sciences

ISSN 1812-5654

**science**  
alert

**ANSI***net*  
an open access publisher  
<http://ansinet.com>

## Introducing Lean Service to the Blended Learning Educational Environment Structure for Food and Beverage Preparation

S.J. Luo, D.P. Chao, S.T. Lee and L.Y. Hsieh

Department of Tourism and Leisure Management, China University of Technology,  
Zhongshan Road., Hukou Township, Hsinchu County, 30301, Taiwan

---

**Abstract:** The food and beverage industry is now encountering the urgent necessity for industrial upgrade and transformation. Using the concept of lean service, a technological education environment incorporating blended learning and food and beverage preparation can be harnessed to lower costs in education, enhance efficiency and quality and improve industrial competitiveness. In this study, the concept of lean service is applied to food and beverage preparations for the first time. By blending learning with information technology, this study constructs a model of an educational environment that differs from those adopted previously in the hope that students and employees will implement the lean service process in preparation services through a blended learning environment. In the conclusion, this study suggests that schools and companies must harness the benefits of modern information technology and encourage students and employees to learn. The schools and companies must endow these students and employees with sufficient information and response abilities and allow them to become core points of strength that develop with the times.

**Key words:** Lean service, food and beverage preparation, blended learning, information technology, educational environment

---

### INTRODUCTION

According to surveys conducted by the Tourism Bureau, Ministry of Transportation and Communications (MOTC), when visiting Taiwan, most international visitors are deeply impressed by the island's culinary dishes. Consequently, good food is not only a necessity people require for sustenance, it is also an important factor attracting tourists to travel to Taiwan. Previously, food and beverages (F and B) preparation personnel were not required to possess high levels of education if owners of F and B establishments could obtain sufficient capital and talent from these personnel. Now, higher education has become widespread and increasing numbers of students are enrolled in the F and B departments at colleges and universities. This change has transformed F and B preparation personnel in Taiwan from workers with low-levels of education into highly educated employees, prompting a qualitative change in the talent pool for the F and B industry. Consequently, approaches by which to educate "well-trained" and "highly specialized" professional F and B personnel using limited conditions is an important issue scholar's encounter today.

In this study, limited conditions imply the concept of lean management. Lean management is derived from the

manufacturing industry; it is a unique operational model taken from Toyota and developed through a variety of challenges. Processes such as consumer purchase, use, repair and service all compose the lean principle. A member of the Corporate Synergy Development Center in Taiwan, has provided evaluations and counselling for the service industry for several years (Huang, 2011). The application of the lean principle in the F and B service company McDonalds resulted in a 7% increase in employee productivity, a 30% reduction in foodstuff waste and a 15% increase in customer satisfaction with counter service speed. The frequent employee turnover in the F and B industry creates difficulty in communicating work knowledge and maintaining service quality, leading to frequent customer complaints; these complaints, in turn, become issues management has to handle.

The lean principle indicates an operational system that places more emphasis on results and effectiveness than process and not a system that proposes standardized management logic (Fullerton and McWatters, 2001).

Womack and Jones (2005) altered the goal of lean solutions into lean consumption. Enterprises can continue creating values with their customers only by integrating lean service and lean consumption. In addition, the

theoretical study performed by Kivela and Crotts (2006) and suggested that although relevant research exists regarding traditional F and B service industries, the integration of lean service and lean consumption remains a novel topic of study in the field of F and B service. Current understandings indicate that the experience of consumers concerning F and B generally centers on their unforgettable memories of service events. Thus, methods by which to introduce the lean principle into the F and B service industry is a point of concern for companies today. This concern leads to the hope of developing and establishing an educational and experience system for F and B preparations using blended learning.

In an age of knowledge economy influenced by continually changing information technology (IT), network technologies have increased the pace of learning. Organizations encounter effects caused by drastic changes in this environment and individual learning and living are also connected to trends in the digitized world. It is important to include the modern IT applications in human resources education training and development. Because of continual renewals in computer software development and application technologies as well as breakthroughs in bandwidth bottlenecks, network or digital learning technologies have changed the educational ecosphere of schools and corporate training systems. This phenomenon is extremely influential in teaching and learning at the management level (Govindasamy, 2001).

When evaluating traditional educational methods adopted in schools and companies, this study considered quotas for entrance, temporal and spatial flexibility and cost and resources logistics. These factors did not satisfy the multiple requirements students and company employees have regarding learning large amounts of material, rapid learning, learning at any time, learning at any location, interactive learning, community learning and diversified knowledge. This study implements the spirit of lean service through IT and develops a teaching curriculum for F and B preparations and an experience system. These achievements will be expanded into a blended learning educational environment for the development of human resources for lean F and B preparations. Blended learning employs technology using physical, synchronized online, or unsynchronized online methods to transmit course content to learners. The most commonly encountered method of blending is adding online learning into the physical classroom (Oliver and Trigwell, 2005). This study develops an educational environment for F and B preparation that provides experience to students using a physical classroom, online

learning and actual operations. Students and company employees can use these techniques to implement progress in lean service through the blended learning environment. Consequently, schools and companies must use the benefits provided by modern information technology and encourage students and employees to learn. They must endow these students and employees with sufficient information and response abilities and allow them to become core points of strength that develop with the times.

Lean service is an innovative applied technique that can be employed in F and B preparations. With rapidly changing developments in technology, innovations and changes that combine different methods, paths and media are becoming new trends in education. In addition, the familiarity of the present generation of students with information technology and their methods of speed reading and learning can enhance the ability of teaching technology and real work in creating harmonic benefits for learning and working (Chou, 2007). Consequently, developing and researching a simulated teaching and experience system for lean F and B preparations and establishing a blended learning environment can provide more convenience and flexibility for learning, generating an optimal balance between pedagogical goals and learning efficiency.

The age of service industries has arrived and numerous companies intend to introduce lean thinking into their services because of its wide and successful applications in the manufacturing industry. However, the meaning of lean must be understood before this application of lean thinking occurs. The central idea in lean is the removal of unnecessary waste during the production process. If resources are consumed without creating value, they become waste. Taiichi (1988) defined seven types of waste that create no value: Over-production, defects, inventory, transportation, waiting, motion and over-processing. Liker (2004) proposed an eighth type of waste: inappropriate design. If these types of wastes can be removed and the manufacturing process continually improved, a perfect lean production enterprise should be achieved. Womack and Jones (2005) were the first scholars to apply the principles of “zero waste, zero defects and precise value” to the consumption end of the equation; they emphasized that lean consumption should consider production, service and consumption as three areas in which to eliminate waste. The priority of this approach is satisfying customer demand which further reduces company costs and creates “win-win” situations for both customers and companies. Liu *et al.* (2011) further

proposed that only appropriate services, products and post-sales requirements could create customer values and integrate lean consumption and lean service.

In other words, the food and beverages industry is a service industry that sells the joy of eating to customers. In Taiwan, the F and B industry is mainly designed to facilitate restaurant evaluation and supervision. According to F and B evaluation reports from the Department of Health (Taipei City government), the F and B industry in Taiwan can be categorized into five general types: tourism hotels, restaurants, buffets and lunchboxes, cold drinks and roadside stands (Kao, 2002). Recently, phenomena such as social advances, economic prosperity and increases in dual-income families and single parent families have led to increasing numbers of people dining out. In addition, consumer demand for diversity and quality in food and beverages has provided numerous opportunities and areas for development in the F and B industry.

Characteristics of work in the F and B industry include long hours, standardization difficulties, labor-intensive service and changing environments. F and B products are characterized as customized, real-time (rapid), difficult to store, difficult to predict and difficult to standardize. Consequently, personnel who prepare F and B products play crucial roles in supporting management for F and B business services. The education of well-trained or highly specialized F and B preparation personnel has become an important school in the applied sciences. In this study, this study constructs an educational environment using the blended learning model and based on the spirit of lean service and requirements for F and B preparations by integrating the education environment and the technology acceptance model (TAM).

Davis (1986) designed TAM as shown in Fig. 1. The goal of TAM in this study is to provide a generalized explanation concerning the determining factors in user acceptance of the blended learning information system. Thus, TAM is used to investigate closed and forced blended learning information systems in organizations. The Technology Acceptance Model was a tool proposed

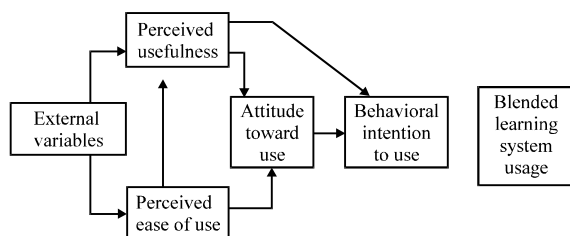


Fig. 1: Diagram of technical acceptance model (TAM) Davis (1986)

used to evaluate or predict levels of user acceptance toward a new IT system. The theoretical basis of TAM is derived from the Theory of Reasoned Action (TRA). Fishbein and Ajzen (1975) proposed that, under the assumption of reasoned action, people undergo a process of conscious mental rationalizing before making potential choices in action. TRA is mainly a study of behavioural intentions in which variables are behavioral attitudes and subjective norms. An assumption is made that users are required to accept these systems because of their learning or working environments; thus, subjective norms are not considered and attitudes are the main factor in user acceptance of these systems.

Davis (1989) proposed that perceived usefulness and perceived ease of use show significant positive correlation to system usage. Lederer *et al.* (2000) Indicated that perceived usefulness and perceived ease of use can predict the behavioural intention of Internet users. Results from a study conducted by Ndubisi (2006) showed that both TAM and the Theory of Planned Behaviour (TPB) can predict intention to use online learning, but TAM outperforms TPB. Usefulness, ease of use and attitude are significant prediction factors. A study conducted by Chen (2009) discovered that the information knowledge possessed by teachers had a significant positive influence on the perceived usefulness of, perceived ease of use for and intention to use wireless networks for teaching.

Marsh (2001) has indicated that although blended learning has gained increased attention in the past few years, the concept of blended learning has existed for more than a decade. All learning methods involving the integration of IT (including e-mail, TV broadcasts and the Internet) and traditional teaching are part of blended learning. Aspects of blended learning include the following:

- Models Combining Web-based Technologies: Live virtual classrooms, collaborative learning and video streaming
- Combining Pedagogical Approaches: (Such as constructivism, behaviourism and cognitive) and instructional technologies to achieve the most suitable learning results
- Combining Any Teaching Technology: (Such as video tapes, CD-ROMs and films) with face-to-face instructor-led training.
- Combining instructional technologies and actual job tasks to create a coordinated effect between learning and working

Singh (2003) adopted blended learning architecture from Khan, as shown in Fig. 2. This architecture provided

a blueprint for planning, developing, managing and evaluating blended learning systems and suggested that blended learning integrated various event-based activities, such as face-to-face instruction, synchronized Web learning and self-guided learning.

Derntl and Motschning-Pitrik (2005) proposed a Blended Learning System Structure (BLESS) which provided a technique for the visual modeling of blended learning. In BLESS, blended learning is separated into smaller learning activity patterns as shown in Fig. 3. This approach allows effective application of learning technologies and can even serve as a guideline for blended learning class design. (Osguthorpe and Graham, 2003) maintained that the richness of instruction, channels of information, social interaction, self-management, cost-effectiveness and ease of return were the six focal points of blended learning design. This approach emphasizes that the instructor can determine the most suitable modes of teaching in their respective field which enhances instructor ability to generate a learning atmosphere and increase motivation to learn. Hong (2003) conducted related studies concerning online courses, proving that integrating online and physical instruction is

the only approach by which to both implement information technology and instruction blending and consider learning achievements, educational effectiveness and economic benefits.

Blended learning combines traditional face-to-face instruction and learning through Web information. In this

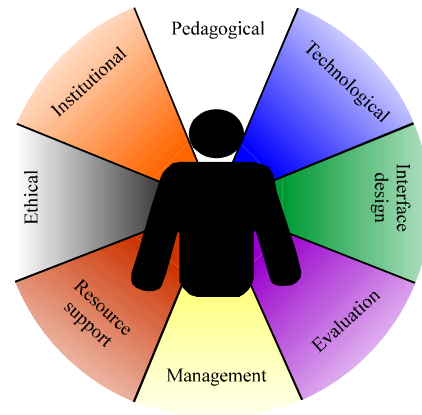


Fig. 2: Khan's blended learning architecture diagram Singh (2003)

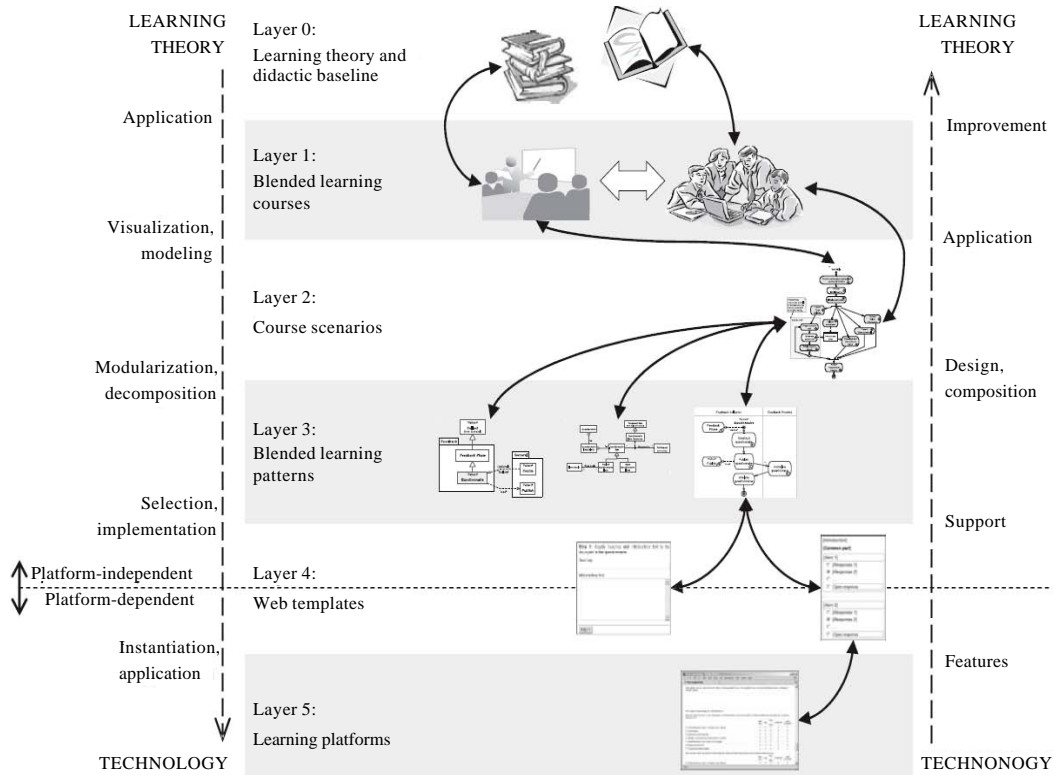


Fig. 3: The blended learning systems structure (BLESS) model Derntl and Motschning-Pitrik (2005)

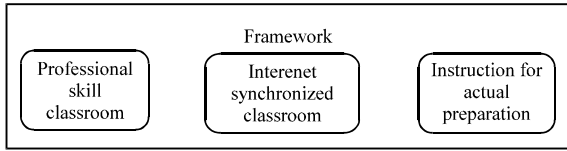


Fig. 4: Conceptual framework for blended learning educational environment

approach, courses are designed so that class time occurs in the traditional classroom and then continues in educational activities conducted through the Internet, e-mail, TV and other broadcasts. Thus, time spent in the traditional classroom is reduced, student learning achievements are improved and dropout rates decrease (Dziuban *et al.*, 2004). Aspden and Helm (2004) attempted to connect physical students with online students in a blended learning environment to create an effective learning and teaching experience. Terashima *et al.* (2004) maintained that, in multimedia courses, the blended learning model could install an active spirit in students. In addition, Tsai (2009) applied blogs to blended learning. The result of this study indicated that using blogs for blended learning offered students real-time responses from instructors and other students which increased their degree of participation and their motivation to learn. The blog method was also effective for controlling learning content, documenting learning trajectory and reflecting student ideas and thoughts.

The findings of Wu *et al.* (2010) provided insight into factors that were possibly significant antecedents for planning and implementing a blended e-learning system to enhance student learning satisfaction. In their study, Chen and Zheng (2010) demonstrated that adult students accepted online learning models and achieved increased knowledge and consolidation of learning through interaction and sharing in virtual communities. They also discussed the meaning and application of online learning models for pedagogy. The present study referenced TAM and the theories and practices of blended learning and developed a blended learning educational environment for F and B preparations. The conceptual framework for this blended learning educational environment is shown in Fig. 4.

**STRUCTURAL MODEL**

In this study, the Design-based Research (DBR) structural model was adopted to develop a blended learning educational environment. DBR is a method that is both systematic and flexible. This method enhances the realization of education through repeated research,

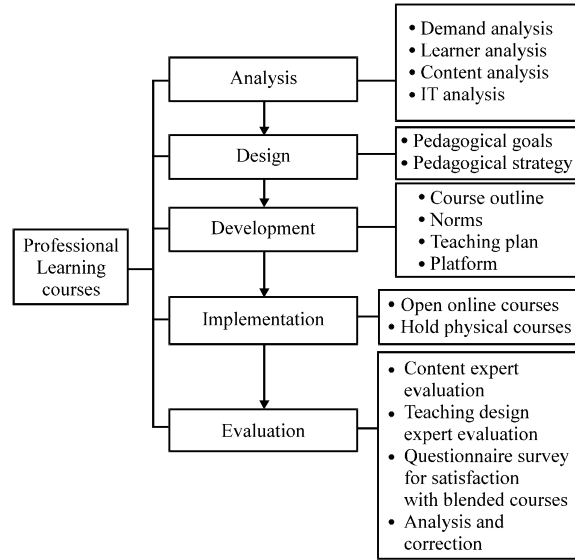


Fig. 5: ADDIE structural model (Shyu, 2003)

design, development and implementation (Wang and Hannafin, 2005). This study used the ADDIE process which is currently the most common application model for digital course developments (Shyu, 2003), to design online learning courses. The letters in ADDIE stand for the following: A: Analysis, D: Design, D: Development, I: Implementation and E: Evaluation. During the analysis stage in ADDIE, the characteristics of learners are understood, related information on course preparation is collected and pedagogical goals and the scale of courses are confirmed. This stage includes learner analysis, learning content analysis, learning goal analysis, information technology analysis and cost-benefit analysis. After analysis is completed, ADDIE proceeds to the design stage. This stage includes project timeline planning, course architecture design, interface design, course material design and the assignment of tasks to workers. Development represents the stage during which courses are prepared. The output from completed development must be evaluated and corrected before the next stage of ADDIE begins. During the implementation stage, instructors and learners implement and use courses. The evaluation portion of ADDIE includes formative evaluation and summative evaluation. Formative evaluation is a test given before course material has been applied. The test assists course developers in determining areas that must be improved. Summative evaluation is performed after course material has been applied. It mainly presents evaluation information to decision makers to determine if courses can be used in the future (Smith and Ragan, 2004; Chen and Yang, 2006). The ADDIE structural model employed in this study is shown in Fig. 5.

**RESULTS**

This study is the first to introduce the concept of lean service into the F and B service industry. Although they are not a panacea, the approaches used in this study should assist the construction of an educational model for new ideas in F and B preparation to develop smoother service processes and achieve optimal learning effects without increasing learning load. This is consistent with Womack and Jones (2005) had put forward arguments. In addition, incorporating blended learning into the design of the IT learning environment will improve and provide for the design of a more perfect educational environment.

Blended learning integrates various online networks and traditional learning resources to achieve the most effective learning results and economically beneficial strategies for introducing technology learning (Dziuban *et al.*, 2004). The unique advantages of technological learning satisfy the multiple requirements of students and company employees regarding learning large amounts of material, rapid learning, learning at any time, learning at any location, interactive learning, community learning and diversified knowledge Davis (1986). However, progress toward a fully digitized learning environment is fraught with difficulties, including

problems with software-hardware resource logistics and plans for complementary measures. Consequently, discovering the proper uses for blended learning to proceed with strategic plans for technological human resources development is an important research direction in current higher education.

The main structure of the blended learning educational environment for F and B preparation adopted in this study is shown in Fig. 6. The structural functions of this model are analyzed as follows.

**Instructor system:** The instructor system involves the construction of a server for the school to provide a platform for massive data exchange. This server allows instructors to produce content for teaching plans (including course outlines, norms, educational materials, digital audio-video displays and production technologies) using a variety of digital tools and upload this content to the instructor system. Students can then easily download this content and compare it with their actual work which improves mental processes and the effectiveness of learning in students

**Information and communication technology (ICT):** With the Internet and service links provided by information and communication technology (ICT) operators in Taiwan

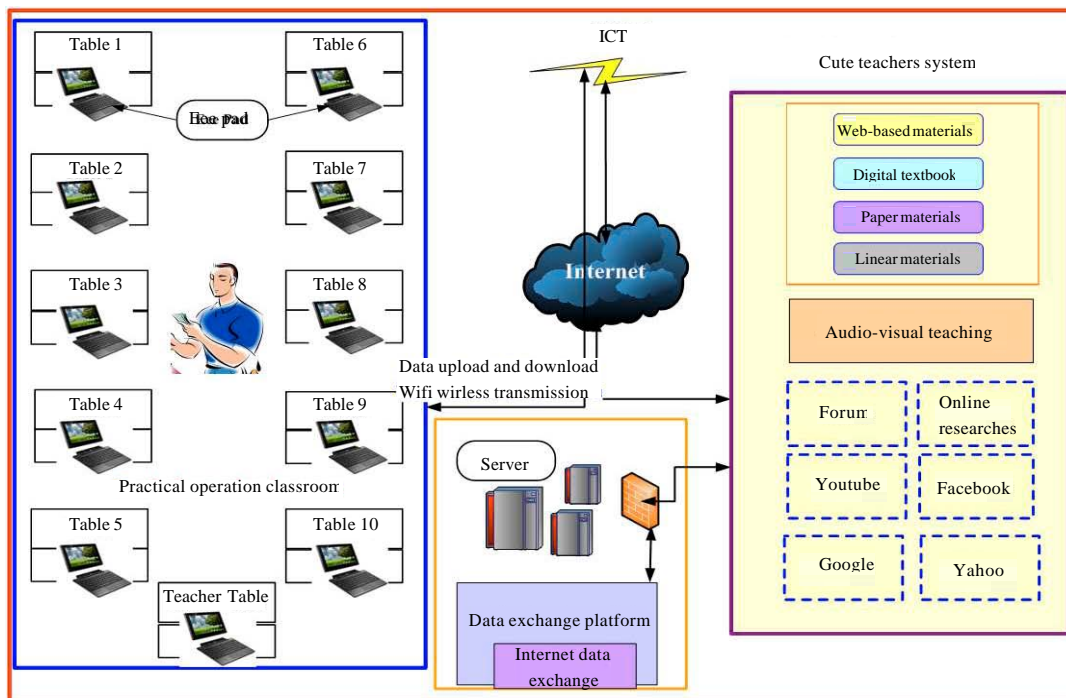


Fig. 6: Model of the blended learning educational environment for F and B preparation

(who already provide fiber-optics transmission), massive digital downloads of course material can become available with great rapidity.

**Internet:** The power of the current Internet aids students in finding relevant information. Repeated display on computer systems can assist students in understanding concepts they are unaware of and in turn, can provide knowledge. Among Internet applications, teaching using Web videos is an attractive option. The integration of this Internet application with original teaching resources should be encouraged. YouTube is a popular website. Although it provides search channels, the wide array of content on the Web site should be filtered to determine those video clips that satisfy the requirements of a specific course.

**E-mail:** Employing e-mail and group discussions is an inseparable part of harnessing the Internet for educational courses. Online forums can be important venues for course discussions conducted between teachers and students. Online forums record all issues discussed by students and teachers (content-based or otherwise).

**Interactive social learning:** Interactive social learning methods, including experience and knowledge exchanges performed during interactions using various text, image, or audio-video blogs; forums; Google; Yahoo and Facebook can also be employed. Participants or viewers can form collective knowledge exchanges and interactions when browsing, creating a knowledge system on the Web and providing the knowledge in this system for limitless adoption.

**Actual operating classroom:** Eee Pads can be inserted into traditional F and B working tables, providing technical tools for the learner or preparer. Using the various functions of the Eee Pad, the learner or preparer can use the touch screen to browse a course or can create reports using the keyboard. Consequently, a wired and wireless transmission environment is developed in the actual operation classroom which allows the learner or preparer to achieve learning goals using the technological environment.

Whether teaching is conducted in a classroom or an online setting, three dimensions of education must be considered: Knowledge, teaching and emotion. In traditional classroom settings, teachers often focus only on knowledge dimension because of strict schedules. When establishing online courses, teachers have continued to adopt this tradition and have focused solely on knowledge discussion when leading online courses.

This approach ignores emotional transactions occurring between teachers and students and between students and their peers. In this situation, teachers cannot flexibly adjust teaching strategies and content according to the learning conditions of students which causes dry and unappealing online interactions. Thus, constructing a blended learning educational environment is an important step in the implementation of modern education through technology.

## CONCLUSION

Lean thinking is not only a tool used for improvement, it is also a complete educational management thinking system. Katayama and Bernet (1996) indicated that lean production is a dynamic system that requires comparatively little resource input but increases value output. This study constructs a relevant blended learning educational environment model for F and B preparations, introducing the essence of lean thinking into educational training for F and B and promoting a series of training courses on lean F and B preparations. Using information technology, this study tries to develop the independent thinking and multiple capabilities of trainees to achieve goal of creating value.

Before introducing lean service, this study must strengthen promotion and education for the lean service concept. Trainees should also be encouraged to develop creative thinking as well as ideas that “breaks rules.” All personnel in the F and B service industry should be encouraged to participate in blended learning educational courses and improve using these courses. During educational training, uninterrupted application of training courses increases knowledge of information technology and improves working ability. With complete educational training systems, trainees can obtain diversified learning and apply their learned skills when working, improving both work efficiency and quality.

## REFERENCES

- Aspden, L. and P. Helm, 2004. Marking the connection in a blended learning environment. *Educ. Media Int.*, 41: 245-252.
- Chen, M.Y., 2009. Effect of internet environment and information literacy on teaching will with wireless network: An example of humanities and art education of junior-high schools in Kaohsiung city. Master's Thesis, Institute of Communications Management, National Sun Yat-Sen University, Taiwan.
- Chen, N.S. and J.T. Yang, 2006. *E-Learning Theory and Practice*. Dr. Master Press Co. Ltd., Taipei, Taiwan.



- Chen, Y.L. and S.H. Zheng, 2010. Digital learning and virtual community in adult education: A study of behavioral intention in blended learning. *J. Inform. Manage.*, 17: 177-196.
- Chou, C.P., 2007. Blended learning aspects. *J. Learn. Forum Mon.*, 80: 10-20.
- Davis, F.D., 1986. A technology acceptance model for empirically testing new end-user information systems: Theory and results. Ph.D. Thesis, Sloan School of Management, Massachusetts Institute of Technology, Cambridge, MA., USA.
- Davis, F.D., 1989. Perceived usefulness, perceived ease of use and user acceptance of information technology. *MIS Q.*, 13: 319-340.
- Derntl, M. and R. Motschnig-Pitrik, 2005. The role of structure, patterns and people in blended learning. *Internet Higher Educ.*, 8: 111-130.
- Dziuban, C.D., J.H. Hartman and P.D. Moskal, 2004. Blending learning. *Educ. Center Applied Res. Bull.*, 7: 1-12.
- Fishbein, M. and I. Ajzen, 1975. *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*. 1st Edn., Addison-Wesley, Reading, MA., USA.
- Fullerton, R.R. and C.S. McWatters, 2001. The production performance benefits from JIT implementation. *J. Oper. Manage.*, 19: 81-96.
- Govindasamy, T., 2001. Successful implementation of E-learning: Pedagogical considerations. *Internet Higher Educ.*, 4: 287-299.
- Hong, H.F., 2003. A study of using E-learning workshop to help elementary mathematics teachers to improve their teachings: A case study under the K12 digital school project. Master's Thesis, Graduate Institute of Mathematics and Science Education, National Ping-Tung University of Education, Taiwan.
- Huang, C.Y., 2011. JIT lean logistics technology. Corporate Synergy Development Center. <http://training.csd.org.tw/literary.php?KindID=21>.
- Kao, C.Y., 2002. *Food and Beverage Management-Theory and Practice*. Yang Chih Book Co. Ltd., New Taipei, Taiwan.
- Katayama, H. and D. Bennett, 1996. Lean production in a changing competitive world: A Japanese perspective. *Int. J. Oper. Prod. Manage.*, 16: 8-23.
- Kivela, J. and J.C. Crotts, 2006. Tourism and gastronomy: Gastronomy's influence on how tourists experience a destination. *J. Hospitality Tourism Res.*, 30: 354-377.
- Lederer, A.L., D.J. Maupin, M.P. Sena and Y. Zhuang, 2000. The technology acceptance model and the world wide web. *Decision Support Syst.*, 29: 269-282.
- Liker, J.K., 2004. *The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer*. 1st Edn., McGraw-Hill, New York, USA.
- Liu, M.T., C.Y. Huang and C.H. Ku, 2011. Linking up lean service with lean consumption. *J. Qual. Mag.*, 47: 21-27.
- Marsh, J., 2001. How to design effective blended learning? T J Taylor. [http://www.academia.edu/1142674/How\\_to\\_design\\_effective\\_blended\\_learning](http://www.academia.edu/1142674/How_to_design_effective_blended_learning).
- Ndubisi, N., 2006. Factors of online learning adoption: A comparative juxtaposition of the theory of planned behaviour and the technology acceptance model. *Int. J. E-Learn.*, 5: 571-591.
- Oliver, M. and K. Trigwell, 2005. Can 'blended learning' be redeemed? *E-Learn. Digital Media*, 2: 17-26.
- Osguthorpe, R.T. and C.R. Graham, 2003. Blended learning environments: Definitions and directions. *Q. Rev. Distance Educ.*, 4: 227-233.
- Shyu, H.Y., 2003. Model of e-learning curriculum development. *J. Educ. Res.*, 116: 15-30.
- Singh, H., 2003. Building effective blended learning programs. *Educ. Technol.*, 43: 51-54.
- Smith, P.L. and T.J. Ragan, 2004. *Instructional Design*. 3rd Edn., John Wiley and Sons Inc., Hoboken, New Jersey, ISBN:13-978-0-471-39353-5.
- Taiichi, O., 1988. *Toyota production system*. Corporate Synergy Development Center, Taipei, Taiwan.
- Terashima, K., R. Ikai, Y. Yoshida, M. Kamei and K. Kubota, 2004. Blended learning model for multimedia production course. *Proceedings of the World Conference on Educational Multimedia, Hypermedia and Telecommunications*. June 21-26, 2004, Lugano, Switzerland.
- Tsai, Y.W., 2009. Blended learning via blogging: The impact of blog-assisted instruction on learning satisfaction. Master's Thesis, Department of Communication, National Chung Cheng University, Taiwan.
- Wang, F. and M.J. Hannafin, 2005. Design-based research and technology-enhanced learning environments. *Educ. Tech. Res.*, 53: 5-23.
- Womack, J.P. and D.T. Jones, 2005. *Lean Solutions: How Companies and Customers can Create Value and Wealth Together*. 1st Edn., Simon and Schuster, NeFree Press, ISBN-13: 978-0743277785, Pages: 368.
- Wu, J.H., R.D. Tennyson and T.L. Hsia, 2010. A study of student satisfaction in a blended e-learning system environment. *Comput. Educ.*, 55: 155-164.