Evaluation of Training Effectiveness of Emergency Medical Technician-I in Central Taiwan

Shyuemeng Luu*
School of Health Administration, Dalhousie University
Halifax, NS, Canada, B3H 1R2

Huan-yan Lai
Department of Medical Affair, Chun Shan Medical University Hospital
Taichung, Taiwan, 40201

Yi-ru Jhang
Department of Public Health, Chun Shan Medical University
Taichung, Taiwan, 40201

*Corresponding Author: s.luu@dal.ca

ABSTRACT

This study examines the effects of demographics, learning environment, instructors, and teaching assistants on training effectiveness of Emergency Medical Technicians-I. A conceptual framework and a questionnaire were developed based on Kirkpatrick's four-level model and Donabedian's use of structure, process, and outcome. 473 Emergency Medical Technicians-Is in six counties in central Taiwan participated in the cross-sectional survey. Structural equation modeling indicated that training effectiveness was positively influenced by capability enhancement, instructor expertise, opportunity provided for practice, rating of instructor lecturing, and willingness to learn of the trainees. In addition, lack of self confidence to apply emergency medical skills and the number of students in a group for general emergency medical equipment practice decreased training effectiveness of Emergency Medical Technician-Is. The role and function of teaching assistants were ambiguous and offset the contribution of instructors. Trainees need to concentrate on both theory and practice parts of the course to enhance emergency medical care capability. Instructors not only provide expertise in teaching emergency medical knowledge and skills, but serve as facilitators in motivating trainees. Training facilities and fire departments need to offer more practice opportunity to Emergency Medical Technician-Is.

Key words: Emergency Medical Technician, Training effectiveness, Structural equation modeling.

INTRODUCTION

In 1995, the Legislative Yaun of Taiwan approved the Emergency Medical Care Services Act (Chiang et al., 2009) which outlines a three-tier Emergency Medical Technician (EMT) system of EMT-I, EMT-II, and EMT-P (Paramedic). The Act designated the National Fire Agency, Ministry of the Interior, to execute prehospital care including dispatching, triage, resuscitation, transporting, and prehospital care record documenting (National Fire Agency, 2009a). The structure and responsibility of EMT-I, -II, and -P are similar to EMT-B (Basic), EMT-I (Intermediate), and EMT-P (Paramedic) in North American prehospital care systems.

In 2008, there were 752,823 dispatches in Taiwan, a 4.4% increase from 2007 (National Fire Agency, 2009b). Of the 609,506 users, 162,891 did not need medical attention. The leading cause for dispatch, by number of people involved, was traffic collisions with 232,827 victims, followed by other medical emergency (194,881), other causes (100, 313), falls and general wounds (66,344), and loss of consciousness due to unknown cause (15,141).

The cost for emergency medical care was 13,600 million New Taiwan dollars in 2007, accounting for 17.63% of the total medical expenses in Taiwan (Department of Health, 2009) compared to 17.38% the previous year. Emergency medical care expenses had an increase of 7.3% between 2006 and 2007. The five leading cost drivers for emergency medical care were injury and poisoning; symptoms, signs and ill-defined conditions; diseases of the digestive system; diseases of the respiratory system; and diseases of the circulatory system. An increasing trend of emergency medical care utilization and cost suggests the need to address the quality and effectiveness of prehospital care. The following sections discuss literature review, theoretical framework, methodology, study results, and conclusion and recommendations.

LITERATURE REVIEW

EMTs frequently encounter patients requiring various emergency care techniques. These techniques need to be validated from time to time. EMT skill assessment such as airway management with or without oral endotracheal intubation is identified as the first procedure to preserve patients' vital signs (Bradley et al., 1998; Pratt & Hirshberg, 2005). Application of Cardiac Pulmonary Resuscitation (CPR) or defibrillation on cardiac arrested patients serves as the second step to rescue patients in a prehospital setting (Chang & Lin, 2005; Ma et al., 2007). Intraosseous (IO) access (Miller et al., 2005; Spriggs et al., 2000) and patient transportation with or without resuscitation (Bayley et al., 2008; Schmidt et al., 2000) are also common issues identified in EMT research.

Landis et al. (1989) compared four patient triage methods: moulaged live trauma victims, nonmoulaged live trauma victims, nonmoulaged manikin trauma victims, and written scenarios. The authors concluded that moulaged live victims and written scenario were comparable and both were significantly superior to the other two methods. Hale and Sipprell (2000) pointed out that EMT-Bs with proper training were able to identify wounds eligible for prehospital treatment and applying tetanus accurately. Risavi et al. (2001) also found a similar educational effect for patient triage in a mass casualty incident among 109 prehospital providers with pre- and post-test designs.

Belz et al. (2006) studied 164 suspected opioid overdose patients and concluded that the medication of naloxone should be administered if EMTs had received proper training. In an acute myocardial infarction (AMI) study, Funk et al. (2000) revealed that EMT-Ps were able to apply aspirin on AMI patients if they had received adequate training. In a one-year study of bronchospasm, EMT-Bs received a four-hour curriculum in order to identify bronchospasm, based on a treatment protocol, and administer albuterol sulfate. Markenson et al. (2004**)** indicated that there was an 87.4% match rate between EMT-Bs and an emergency department physician among 190 patients treated with albuterol sulfate. The authors concluded that it is necessary to develop a protocol allowing EMT-Bs to administer the medication.

The above mentioned studies center around two main themes: single EMT skill assessment and the benefit of continued education. Studies such as these are unable to improve the comprehension on the effect of an EMT training program as a whole. In a US national survey of 120,495 EMT-Bs and 45,447 EMT-Ps, Dawson et al. (2003) investigated 46 demographic and 16 education questions. The study results indicated that both EMT-B and EMT-P were satisfied with the training program and felt well prepared by certification courses in terms of trauma assessment, medical assessment, cardiac arrest management, and airway management. The study, however, was merely descriptive research without any multivariate analysis. It was unable to identify factors contributing to the success of program or trainees' satisfaction. Arreola-Risa et al. (2007) investigated the effectiveness of EMT-B training program in a 14-month period. The outcomes were compared before and after the training session for 807 and 1,856 patients, respectively. The major achievement of the program was that the adjusted mortality rate decreased from 1.8% to 0.5% ($p=0.002$). The authors, nevertheless, failed to establish the association between the improvements, i.e. decreased mortality rate, and the elements in training program.

The purpose of this study is to answer the following questions:

- What individual attributes contribute to the success of the EMT training outcomes?
- What is the impact of the learning environment to the success of the EMT training outcomes and size?
- What influence does an instructor or a teaching assistant contribute to the success of EMT training outcomes, their magnitude, and mechanism?

THEORETICAL FRAMEWORK

Kirkpatrick (1996) proposed a four-level model for evaluating a training program, which is an extension of his previous work of "Technique for evaluating training programs". The four levels include:

- Reaction: It asks the question of "How did trainees react to the program?" It is a measure of satisfaction of how participants feel about a training program including the topic, speaker, and schedule.
- Learning: The question asked is "Did trainees really learn or improve their knowledge or skills?" It measures how much knowledge and skills the trainees have learned or improved after the training.

- Behavior: It asks “Have trainees brought something back from the training program and used it in the workplace?” It measures how the trainees transfer/apply the knowledge and/or skills they have learned to their work setting.
- Results: The question centers on “Does the organization or individual gain any improvement or success from the training?” The final results normally refer to performance improvement including salary increase, increased profits, reduced costs, higher productivity, and improved quality.

Kirkpatrick’s four-level model has been widely applied in training program evaluation. For instance, Baskin et al. (2005) followed 171 subjects of Information and Communication Technologies over a 13-week period. The study results support the model by indicating a communication on learning that expands and branches learning effort, and improves the efficacy of the learner as they move into new group work settings. A study of work safety training in the petroleum industry through mathematical modeling and simulation confirmed the function of the four-level of evaluation (Fakhru'l-Razi et al., 2003). In the arena of medicine, a pain management program, prenatal education program on breastfeeding outcomes, and faculty development program in emergency medicine have employed Kirkpatrick’s model to assess curriculum successfully (Hunter et al., 2008; Lin et al., 2008; Ramalanjaona, 2003).

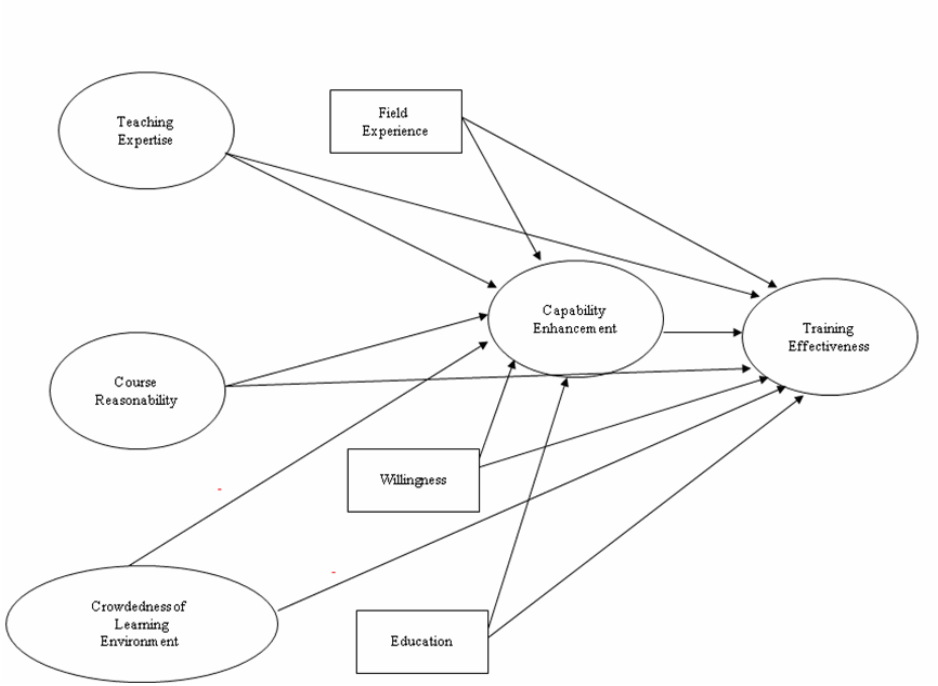
When evaluating Design and Technology students' learning, Haupt and Blignaut (2008) pointed out Kirkpatrick’s model alone is insufficient to explain the complexities. Wong and Wong (2003) reached a similar conclusion on a teacher training program evaluation that Kirkpatrick’s model needs to be supplemented by the Behaviourally Based Impact Evaluation Model (Adams, 2001) and the work of Holton (1996). Holton replaces Kirkpatrick’s model with three outcome measures: learning, individual performance and organizational results. Holton emphasizes the important influences of trainees’ ability, motivation and environment on outcomes as well. Bates (2004) criticizes Kirkpatrick’s model with the following limitations: an incomplete model, causal linkage assumptions, and the incremental importance of information by levels.

Donabedian (1966) proposes a model to evaluate the quality of medical care by highlighting the following three elements:

- Structure: It refers to “the settings in which it takes place and the instrumentalities of which it is the product”, which includes characteristics of both the organization and the individual. Organization attributes consist of the size of the facility, curriculum setup, specialty training, and qualification of the provider. Individual aspects include gender, age, education level, and willingness to receiving training.
- Process: It is the “set of activities that go on within and between practitioners and patients”. Process indicators are interpersonal characteristics such as interaction manner, counseling, and communication level between students and instructors.
- Outcomes: It is defined as “consequences to the health and welfare of the individual and society”. The final outcomes of the training program include error reduction, time saving in patient treatment, and quality improvement.

Combining both perspectives of Kirkpatrick D. (1996) and Donabedian A. (1966), figure 1 illustrates the conceptual model that guides the study. The final outcome of "training effectiveness" signifies "results" at level four in Kirkpatrick's model. "Capability enhancement" is a construct representing a combined "behavior" and "learning" at level three and two. The variables denote "reaction" at level one comprising "teaching expertise", "course reasonability", and "crowdedness of learning environment". The model also includes three individual attributes of "willingness", "education", and "field experience" as suggested by Donabedian's model.

Figure 1: Proposed Conceptual Framework



Training effectiveness, hypothetically, is influenced by the following factors: "willingness", "education", "field experience", "teaching expertise", "course reasonability", "crowdedness of learning environment", and "capability enhancement". The same set of variables influences "capability enhancement" which serves as an intermediate outcome. Other than "crowdedness of learning environment", it is hypothesized that all variables impose a positive effect on both outcome variables.

METHODOLOGY

The research design of this study is cross-sectional without a control group. Participants are certified EMT-Is in six counties in central Taiwan with a minimum of three months work experience in the fire department. Five hundred and eighty three copies of the questionnaire were issued in June, 2005 with 526 copies returned. Among

returned questionnaires, twenty nine copies were deleted due to 50% or more unanswered questions in any of the 5 constructs; questionnaires responded by 24 female respondents that were discarded since their performance was somewhat different from their counterparts. The final sample size was 473 male EMT-Is yielding an effective response rate of 81.13%.

The questionnaire contains 4 quantitative, 36 5-point likert scale questions, and individual attributes of gender, willingness, education level, EMT nature (regular or volunteer), and field experience as the result of panel review by three EMT experts. 75 EMT-Is from two northern counties conducted the pretest. Table 1 shows the questions in each construct and pretested Cronbach's Alphas. Cronbach's Alphas range from 0.627 to 0.944 which indicates a medium to high internal consistency for the constructs (Kane, 1997).

The validation of measurement models was achieved by specifying the relationships between observable variables (indicators) and latent variables (constructs) with or without correlated measurement errors (Bollen, 1989). Structural equation modeling through AMOS was adopted for multivariate analysis to specify casual relationships among constructs and variables in the model. The evaluation criteria for the indicators in a measurement model relied on the values of critical ratio (C.R.) and square multiple correlations (SMC). C.R. should be greater than 1.96 (in absolute value) which indicates the estimate is significantly different from zero at the 0.05 level. SMC should be greater than 0.5, i.e., it shares at least 50% of its variance with its construct (Sharma, 1996). These guidelines remove statistically insignificant indicators that are not measuring the corresponding construct.

The structural equation model specifies the causal relationships among the exogenous variables and endogenous variables. The following guidelines evaluate the model fit:

- The chi-square test (X^2) assesses the proposed model against the alternative model. The p-value should be larger than 0.05. However, the sample size has substantial influence on chi-square statistics. Hence, the chi-square statistic should be examined in conjunction with other indices.
- A likelihood ratio of chi-square statistic to degrees of freedom less than five suggests that the model is reasonable and acceptable (Bollen, 1989).
- The goodness-of-fit (GOF) should be higher than 0.90.
- The adjusted goodness-of-fit (AGOF) index should be greater than 0.80.
- The root mean square error of approximation (RMSEA) should be less than 0.05; however, 0.08 is also acceptable.
- The Hoelter's Critical N should be greater than 200.

RESULTS

Table 1 presents the mean and standard deviation (SD) of each indicator and corresponding constructs. The majority of studied subjects were regular EMT (98.94%) with an average age of 28.792 (SD = 9.740). On average, they have received 12.850 years of education (SD = 1.907) and have a high willingness to participate in EMT training as evidenced by the mean of 7.553 (SD = 2.293), from a scale of 1 to 10. Since EMT-I is a beginner level, the subjects had only 15.290 months of field experience (SD = 30.409). There were 42 students in a classroom for theory courses (SD = 11.940), 3 students in a

group for general EMT equipment practice (SD = 1.826), 8 students in a group for vital EMT equipment practice (SD = 8.701); with 9.836 sessions of CPR (SD = 9.581). As for indicators measured on a 5-point likert scale, the lowest mean was 3.057 and the highest was 3.873, for "crowdedness rating of theory course" and "professional knowledge of instructor", respectively.

Table 1: Descriptive Statistics of Construct, Indicators and Cronbach's Alpha

Construct	Indicator	Mean	S.D.	Cronbach's Alpha
Training Effectiveness	Error reduction (ERR_R)	3.831	.648	0.627
	Quality improvement (QUA_I)	3.846	.653	
	Efficiency improvement (EFF_I)	3.810	.681	
	Increase job satisfaction (SUCES)	3.799	.710	
	Provide consultation (CONLT)	3.628	.734	
	Lack of self-confidence to apply EMT skills (CONF_L)	3.285	.930	
	Sufficient opportunity for EMT skill application (OPPU)	3.310	.929	
Capability Enhancement	Absorption of theory course (TH_ABS)	3.569	.661	0.916
	Absorption of skill practice (PR_ABS)	3.556	.671	
	EMT concept improvement (CONCP)	3.841	.691	
	Rescue ability improvement (ABITY)	3.846	.647	
	Apply EMT skills smoothly (APPLY)	3.696	.661	
	Improved quality of communication with patient's relatives (REL_COM)	3.592	.698	
	Improved quality of communication with ER staff (PRO_COM)	3.338	.742	
Teaching Expertise	Oral presentation skill of instructor (INS_O)	3.776	.651	0.944
	Writing skill of instructor (INS_W)	3.655	.652	
	Lecture offered by the instructor (INS_L)	3.416	.626	
	Discussion offered by the instructor (INS_D)	3.161	.676	
	Practice offered by the instructor (INS_PT)	3.326	.731	
	Professional knowledge of instructor (INS_PK)	3.873	.714	
	Rescue ability of instructor (INS_RA)	3.835	.727	
	Attitude of instructor (INS_AT)	3.833	.759	
	Oral presentation skill of teaching assistant (TA_O)	3.689	.666	
	Writing skill of teaching assistant (TA_W)	3.619	.660	
	Lecture offered by teaching assistant (TA_L)	3.249	.649	
	Discussion offered by teaching assistant (TA_D)	3.216	.673	
	Practice offered by teaching assistant (TA_PT)	3.332	.693	
	Professional knowledge of teaching assistant (TA_PK)	3.693	.681	
	Rescue ability of teaching assistant (TA_RA)	3.710	.675	
	Attitude of teaching assistant (TA_AT)	3.708	.692	

Table 1: Descriptive Statistics of Construct, Indicators and Cronbach's Alpha (Continued)

Construct	Indicator	Mean	S.D.	Cronbach's Alpha
Course Reasonability	Length of time for whole training program (TOL_TM_S)	3.471	.713	0.796
	Length of time for a single course (SIN_TM_S)	3.478	.654	
	Rating of course sequence (CUR_ODR)	3.448	.633	
	Rating of course difficulty (CUR_DIF)	3.110	.632	
	Frequency of cardiac pulmonary resuscitation (ANNI_N)	9.836	9.581	
Crowdedness of Learning Environment	The number of students for theory course (TH_N)	41.926	11.940	0.629
	Crowdedness rating of theory course (TH_P)	3.057	.767	
	The number of students in a group for vital EMT equipment practice (PR_VN)	8.103	8.701	
	The number of students in a group for general EMT equipment practice (PR_MN)	3.025	1.826	
	Crowdedness rating of practice session (PR_ES)	3.182	.795	
Individual Attribute	Age	28.792	9.740	NA
	Education (in years)	12.850	1.907	
	Willingness	7.533	2.293	
	Field experience (in months)	15.290	30.409	
	Regular EMT	98.94%		

The correlation matrix revealed a medium to high multicollinearity and Kaiser-Meyer-Olkin (KMO) of 0.896 indicating that a factor analysis is warranted. Principal Axis Factoring (PAF) with Varimax rotation yielded 10 factors, which were further validated through measurement modeling. The construct of "teaching expertise" disaggregated into "instructor expertise', "TA expertise", and "TA's mode of delivery". Due to discarding two indicators, "course reasonability" turned into "course timing". The construct of "crowdedness of learning environment" was no longer sustained.

Table 2 presents the results of the measurement model validation including model fit as a chi-square (X^2) value with its degrees of freedom (df), probability, and retained indicators along with SMC and C.R.. A just-identified model is the model with only three indicators that used up its df, therefore, both X^2 and df equal to zero. Three retained indicators of "theory absorption" (TH_ABS), "practice absorption" (PR_ABS), and "practice offered by TA" (TA_PT) were due to theoretical concern, even though their SMC were lower than 0.5. The rest of the indicators met the evaluation criteria of SMC larger than 0.5 and C.R. higher than 1.96. The rejected indicators from the measurement models were submitted to structure equation model, along with individual attributes and validated measurement models.

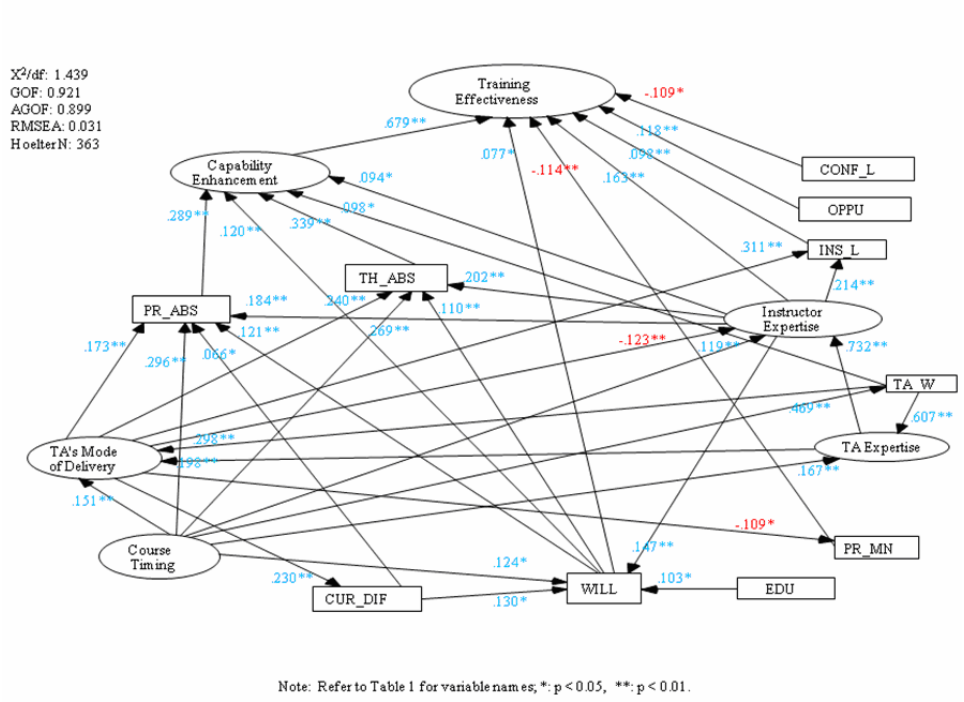
The variance in "training effectiveness" explained by the predictors was 69.7%, even with a large X^2 value of 748.531 and df of 520. The model fit indices denoted a sufficient fit of a likelihood ratio of X^2/df: 1.439, GOF: 0.921, AGOF: 0.899, RMSEA: 0.031, and Hoelter Critical N: 363.

Table 2: Results of Measurement Model Validation

Construct	Model Fit X^2 value df)	Probability	Retained Indicator	SMC	C.R.
Training Effectiveness	0.852 (2)	0.653	ERR_R	0.549	17.266
			QUA_I	0.601	18.480
			EFF_I	0.777	Fixed
			SUCES	0.614	18.384
			CONLT	0.549	15.809
Capability Enhancement	4.382 (4)	0.357	TH_ABS	0.491	14.956
			PR_ABS	0.495	14.994
			CONCP	0.547	13.897
			ABITY	0.687	16.762
			APPLY	0.712	17.692
			REL_COM	0.648	Fixed
Instructor Expertise	Just-identified Model	Just-identified Model	INS_PK	0.895	37.518
			INS_RA	0.871	Fixed
			INS_AT	0.790	31.993
TA Expertise	5.25 (2)	0.072	TA_O	0.531	20.623
			TA_AT	0.866	Fixed
			TA_PK	0.877	37.077
			TA_RA	0.834	34.518
TA's Mode of Delivery	Just-identified Model	Just-identified Model	TA_PT	0.495	16.461
			TA_L	0.816	Fixed
			TA_D	0.716	19.37
Course Timing	Just-identified Model	Just-identified Model	TOL_TM_S	0.745	Fixed
			SIN_TM_S	0.853	21.425
			CUR_ODR	0.501	17.339

For the constructs in the model, "training effectiveness" was dominated by "capability enhancement" followed by "instructor expertise" , "sufficient opportunity for applying EMT skills", "rating of instructor lecture", and "willingness". Both "insufficient self-confidence to apply EMT skills" and "the number of students in a group for general EMT equipment practice" had a negative impact on 'training effectiveness" (Figure 2). As for "capability enhancement", 'theory absorption' and 'practice absorption' were two leading determinants, followed by "willingness", "rating of TA's writing", and "instructor expertise". "TA expertise" heavily influenced "instructor expertise", whereas "course timing" had a lesser impact. "TA's mode of delivery", on the contrary, exercised a negative influence on the construct. "Rating of TA's writing" dominated "TA expertise" and was followed by a minor effect coming from "course timing". "TA's mode of delivery" received influences from "rating of TA's writing", "TA expertise", and "course timing".

Figure 2: Results of Structure Equation Modeling



Note: Refer to Table 1 for variable names; *: $p < 0.05$, **: $p < 0.01$.

As for observable variables in the model, “course timing” was the leading determinant for “theory absorption”, followed by “TA’s mode of delivery”, “instructor expertise”, and “willingness”. In terms of “practice absorption”, “course timing” was the principal factor, followed by “instructor expertise”, “TA’s mode of delivery”, “willingness”, and “rating of course difficulty”. “Rating of instructor’s lecture” had influences from “TA’s mode of delivery” and “instructor expertise”. The only influence for “Rating of TA’s writing” was “course timing”. “Rating of course difficulty” had an impact which originated from “TA’s mode of delivery”. The determinants of “willingness” were “instructor expertise”, “rating of course difficulty”, “course timing”, and “education”. The variable of “the number of students in a group for general EMT equipment practice” received a negative effect from “TA’s mode of delivery”.

DISCUSSION

From the theory point of view, the paths in the model follow the sequence of reaction, learning, behavior, and results, as Kirkpatrick proposed. Both “theory absorption” and “practice absorption” were indicators of “capability enhancement” in the proposed conceptual model. Both became independent variables that signify learning while validating the measurement model. Most of the reaction variables had direct and/or indirect influence on “theory absorption” and “practice absorption”, and both then projected onto the behavior variable of ‘capability enhancement”. The relationships

among elements in the model, however, are not as simple and linear as Kirkpatrick suggested. For instance, reaction variables, direct or indirect, act upon the final outcome, training effectiveness, which suggests a complex relationship exists among variables.

Kirkpatrick's model alone may not explain the complex phenomenon of training effectiveness as Haupt and Blignaut (2008) indicated. By combining models of Kirkpatrick and Donabedian, "willingness" and "education" are two individual attributes retained in the model, whereas "education" provides only indirect influence through "willingness" onto the rest of the variables. "Willingness" has multiple effects on learning, behavior, and results. Although small in magnitude, these effects not only help the explanatory power, but clarify the mechanism of interactions in the model.

The most important factor for "training effectiveness" is "capability enhancement" for EMT-Is in central Taiwan. Formal and organized EMT training is the way to reduce error and improve patient outcome, even though EMTs were confident in their own ability (Haynes & Pritting, 1999; Glaeser, et al., 2000). Both trainees and supervisors recognized that knowledge and skills acquired from the training programs indeed upgrade their performance (Meyer, et al., 2007). It demonstrates that once EMTs have internalized what they learned from the program, the skill set is transferred to EMTs and improves their work performance in terms of error reduction, efficiency, and quality.

"Instructor expertise" is the second determinant for "training effectiveness". Crocco et al. (2003) compared the training effectiveness of a stroke management module conducted by physicians and Advanced Cardiac Life Support (ACLS) instructors. The authors concluded, however, that instructors' expertise is less critical when there is no performance difference found among trainees, though the performance is satisfactory. Instructor expertise, nevertheless, is different for a physician and an EMT instructor in terms of work setting and environment. For EMT trainees in the stroke management module, the expertise of an ACLS instructor may adequately meet their education needs. The outcomes, therefore, are equivalent to trainees taught by either party. This is further evidenced by the indirect influence of "instructor expertise" through "rating of instructor's lecture" onto "training effectiveness". It means that the better the content of an instructor's lecture, the better the performance of the trainees (Berg & Lindseth, 2004; Kelly et al., 2007).

Less practice is one of the contributing factors of failure for prehospital oral endotracheal intubation (Bradley, et al. 1998). Opportunity to use the newly acquired knowledge or skills increases the probability of successful learning and skills transfer (Clarke, 2002). It further provides supports for the positive impact of "sufficient opportunity for EMT skill application" onto "training effectiveness". Stevens and Alexander (2005) found that more practice leads to better confidence, and improved confidence increases the level of comfort in dealing with patients. This finding not only supports the previous statement, but proves that "insufficient self-confidence to apply EMT skills" might jeopardize "training effectiveness". EMT-I trainees practiced their EMT skills on manikins during training sessions. A possible cause of EMT-Is' low self-confidence could be the psychological barrier of performing EMT skills on live patients and/or fear of generating medical errors.

"Willingness", the degree of self-motivation, is a proven factor leading to effective learning outcomes since high motivators are willing to devote more time and effort in learning (Wong & Wong, 2003). Larger class size, however, has been associated with lower learning outcomes (Gibbs et al., 1997). It explains the higher "the number of

students in a group for general EMT equipment practice" depletes the frequency and time of practice, and therefore, the lower the training effectiveness.

In terms of Kirkpatrick's model, "capability enhancement" represents "behavior" or "knowledge/skill transferring" which represents the last part of "process" in Donabedian's model. EMT-Is need to understand not only the theory part of Anatomy and Physiology but the practice sections of triage, CPR, and defibrillator usage to internalize what they learned. The help of "instructor expertise" in clarifying the underlined concept and demonstrating the skill set would facilitate the internalization process. TAs also play a helping role by writing up the course material and providing feedback on exam results to assist EMT-Is capturing the course content (Ocel, et al., 2003). Without personal determination to learn, "willingness", it may be hard for EMT-Is to maintain their motivation on studying, let alone the internalization of the knowledge and skills (Ting, 2000).

Learning, a level-2 element in Kirkpatrick's model, includes both "theory absorption" and "practice absorption". "Course timing" is the most influential factor for both of them. Without carefully arranging the length of time of a single course, total length of time of the entire program, and course order, students might be confused by the concepts they should know but have not been taught. If insufficient time is given for explaining abstract concepts or hands-on EMT skills exercise, it may yield partial understanding of the body of science which may impede students' comprehension (Chance & Rossman, 2001; Halkett & McLafferty, 2006).

An interesting interaction occurs between instructors and TAs since "TA expertise" and "TA's mode of delivery" influence "instructor expertise" in different directions. The former has a positive dominant effect and the latter has a negative impact with a lesser strength. TAs have the following roles (Kessler et al., 2007):

- The Co-Producer: Providing complementary skills to the professional;
- The Relief: Removing burdens from professionals by taking on non-core tasks;
- The Substitute: Taking the place of professionals by performing their core tasks; and
- The Apprentice: Allowing preparation for a move into the profession.

Even though TAs provide their expertise in helping instructors to achieve training objectives, TAs may not be aware that they offer improper explanation to trainees at the time of teaching or practicing. This is evidenced by "TA's mode of delivery" increasing "the rating of course difficulty" and decreasing "instructor expertise" at the same time. It indicates that TAs need more professional development or training on teaching methods (Kelly et al., 2007; Kessler et al., 2007; Park, 2004). As with "theory absorption" and "practice absorption", proper arrangement of course order and adequate length of time for courses may help instructors to clarify the logic of prehospital care (Halkett & McLafferty, 2006).

Lecturing, discussion, and practice are three indicators of the "TA's mode of delivery" that is positively influenced by "rating of TAs' writing", "TA expertise", and "course timing". Clarity in lecturing, intellectual stimulation, and organization are major factors on higher satisfaction with lecturing performance (Ting, 2000). It provides the rationale that "rating of TAs' writing" dominates "TA expertise". Without clear and concise course material, it is hard for trainees to understand the content being taught. Normally, there is more than one TA in a session which explains the negative relationship that exists between "TA's mode of delivery" and "the number of students in

a group for general EMT equipment practice". It also raises the question, however, of the variability of teaching quality among different TAs.

"Willingness", a variable of self-motivation, is the only demographic that has a direct impact on "training effectiveness". Pre-training motivation associates with trainee reactions and motivated trainees demonstrate a greater interest in learning (Sitzmann et al. 2008; Weiss & Cropanzano, 1996). Motivation to learn is primarily related to social norms (Hadera et al., 2007), which is "course difficulty" in the current study. Trainees are challenged by the degree of difficulty which stimulates their desire to overcome the learning barriers. In the meantime, proper "course timing" may help them comprehend the content better and further increase their willingness to learn. "Education", another individual attribute, has an indirect effect on "training effectiveness" through "willingness". Ting (2000) uncovered that the year of education produced the strongest influence on students' effort in studying, i.e., senior students were better motivated than junior ones. Instructors, as mentors, provide ongoing support, guidance, and assistance by offering their expertise and experiences to lead trainees through the learning process. Instructors, as role models, stimulate trainees' mimic mechanism and further enhance their confidence and willingness to learn (Mills & Mullins, 2008; Milner & Bossers, 2004).

The study results illustrate the utility of combining models of Kirkpatrick and Donabedian, nonetheless, this study has following limitations:

- Cross-sectional study design,
- Lack of control/comparison group, and
- Five-point likert measurement is treated as a pseudo-interval scale.

Future studies may wish to adopt a multi-wave with pre- and post-training design to assess the knowledge/skills gained and training effectiveness improvement between the waves. It is advisable to add an EMT-I group from another region or EMT-II as a comparison group to the study, however, researchers should consider both financial and time constraints. Either switching the questions from ordinal nature to interval, or applying SEM with ordinal data should resolve the statistical concern.

CONCLUSION

In assessing training outcomes, Kirkpatrick's four-level model needs to incorporate contextual factors from individual, organization, or environment into model. The fundamental four-level elements sustain it, however, the relationships among factors are not simple and linear ones.

For trainees, motivation is the most important factor in both pre- and post-training stages. Training facilities should encourage instructors to have more interaction with trainees in order to help them acquire the needed expertise. During the course design process, EMT-Is should offer feedbacks on the training received in terms of the sequence of the courses, the length of time for each course and the total training program. TAs need more professional development, clarification regarding their duties, and execution at the right time and place.

Fire departments need to provide more opportunity for EMT-Is to practice their skills through continued education, workshops, or tournaments. It is not only providing a platform for EMT-Is to practice EMT skills, but helping them to crystallize the learning process. Campaigns such as boot camp, team building, or leadership round tables provide

an opportunity to boost self-confidence, increase a sense of belonging, and improve team work for EMT-Is.

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Shyuemeng Luu, Assistance Professor at School of Health Administration, Dalhousie University, Canada earned his Ph.D. in Health Organization and Research at Virginia Commonwealth University. He has taught at Department of Public Health, Chun Shan Medical University, Taiwan, R.O.C. and School of Public Health, National Defense Medical Center, Taiwan, R.O.C.. His research interests are prehospital care, disaster management, and program evaluation.

Huan-yan Lai and **Yi-ru Jhang** are graduates of Department of Public Health, Chun Shan Medical University. They participated in the EMT training effectiveness evaluation project as questionnaire designers, project facilitators, and data collectors and analysts.