Effectiveness of Systematic Interactive Multimedia Instruction on Mastery of Safety Knowledge and Emergency Procedures

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Thesis submitted in fulfilment of the requirements for

the degree of Doctor of Philosophy

UNIVERSITI SAINS MALAYSIA

February 2012

ACKNOWLEDGEMENT

In the name of Allah, Most Gracious, Most Merciful

I am grateful for all the bounties that Allah has showered on me which enabled me complete this thesis.

I start with heartful thanks and love to my family, my beloved wife, Dr. Lina Bani Salameh who shared me the hardships and the sweet memories of living in Malaysia and to my son Hashim and to my two daughters Salama and Farah.

First of all, great thanks to my supervisor

Dr. Merza Abbas

who has guided me throughout the writing of this thesis. He is a unique type of person who devoted his life to his students. My experience with him is deep in my heart when he always came even on weekends to help me and help other students. He is like a caring father to his children. I travelled to many countries in the world and met many people but I have never met a person so devoted like him. Words can not express my thanks to him but I just say, "May Allah bless you and your family Dear Dr. Merza"

I also extend my thanks to my supervisors Dr. Muhammad Kamarul Kabilan and Dr. Leong Lai Mei for their encouragement and help.

I would like to express my deep thanks to the faculty and administrative staff of the School of Educational Studies, University Sains Malaysia, for all their support during my study. My thanks also go to the Institute of Post-graduate Studies (IPS) for their assistance and support. Deep appreciation and respect for my beloved university which made dreams a reality for me, for offering me the USM fellowship and the original knowledge that enabled my to publish in respectful ISI journals.

Special thanks are extended to the CEO of Royal Jordanian airline whose approval and support to conduct this research has been a source of inspiration and motivation that has led me to improve instructional methods of Cabin Safety onboard Royal Jordanian Flights.

Big thanks and appreciation to Chairman of Jordan Aviation Training and Simulation (JATS) for his support and for the data which enriched my research. His help and encouragement has been a source of inspiration to further improve instructional materials on cabin safety training.

Special appreciation is extended to Royal Jordanian airline and to flight attendants and supervisors of Royal Jordanian whose cooperation helped me conduct this research on Cabin Safety Training.

ALHAMDULELLAH

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Keberkesanan Pengajaran Multimedia Interaktif Bersistem terhadap Penguasaan Pengetahuan Keselamatan dan Prosedur Kecemasan

ABSTRAK

Kajian ini meninjau keberkesanan koswer instruksi multimedia bersistematik dan interaktif bersama refleksi dan ulangkaji dalam meningkatkan penguasaan pengetahuan keselamatan dan prosedur kecemasan dalam aspek Kecemasan Terancang, Melawan Api, dan Bantuan Awal, serta kecekapan diri dalam kalangan atendan penerbangan. Sebelas kursus multimedia dibangunkan berpandukan preskripsi hierarki pembelajaran Gagne (1985) dan model reka bentuk pengajaran Dick & Carey (2001). Penilaian formatif telah dijalankan secara bengkel dengan 28 atendan penerbangan manakala penilaian formatif, seperti yang dicadangkan oleh model ini telah dijalankan dengan mengintegrasikan kursus-kursus ini ke dalam tatacara kerja sekumpulan atendan penerbangan dari sebuah syarikat penerbangan antarabangsa. Kajian ini menggunakan rekabentuk ujian pra dan pasca satu kumpulan dengan rawakan. Kawalan terperinci telah dijalankan untuk mengurangkan ancaman terhadap reka bentuk kajian ini. Sampel kajian sumatif terdiri dari 35 atendan dan penyelia penerbangan yang telah pilih untuk kajian ini secara rawak oleh jabatan penjadualan syarikat ini. Tiga instrumen kajian telah dibangunkan untuk mengutip data, iaitu Soalselidik Kebolehpenggunaan, Ujian Pencapaian Keselamatan dan Soalselidik Jaminan Keselamatan Penerbagan. Penyelia penerbangan telah menjalankan aktiviti refleksi dan ulangkaji di dalam sesi taklimat pra-penerbangan yang diadakan sebelum setiap penerbangan. Ujian-t satu sampel digunakan untuk menganalisis data penguasaan kemahiran dan ujian-t sampel bebas digunakan untuk menganalisis data kecekapan diri. Pembolehubah moderator ialah jantina.

Dapatan menunjukkan bahawa prestasi di dalam Kecemasan Terancang, Melawan Api, dan Rawatan Awal meningkat secara signifikan dan min ujian-ujian post melepasi paras 80% yang diperlukan. Analisis skor-skor ini berdasarkan dimensi-dimensi kemahiran intelek juga menunjukkan peningkatan signifikan di dalm diskriminasi, konsep, peraturan, peraturan tahap tinggi, dan juga maklumat verbal dengan peraturan tahap tinggi melaporkan peningkatan terbesar. Dapatan juga menunjukkan bahawa kecekapan diri terhadap Taklimat Pra-Penerbangan, Kesediaan,

dan Kepakaran turut meningkat secara signifikan. Analisis mengikut jantina mendapati bahawa tidak terdapat perbezaan yang signifikan di dalam peningkatan penguasaan di dalam pengetahuan keselamatan dan prosedur kecemasan dan juga kecekapan diri. Dapatan-dapatan ini menunjukkan koswer instruksi multimedia bersistematik dan interaktif bersama refleksi dan ulangkaji berkesan di dalam meningkatkan penguasaan pengetahuan keselamatan dan prosedur kecemasan serta kecekapan diri atendan-atendan penerbangan.

Effectiveness of Systematic Interactive Multimedia Instruction on Mastery of Safety Knowledge and Emergency Procedures

ABSTRACT

This study investigated the effectiveness of a systematic interactive multimedia instruction courseware with reflection and review in enhancing mastery of safety knowledge and skills in the aspects of Planned Emergency, Fire Fighting and First Aid, and self-efficacy among flight attendants. Eleven systematic interactive multimedia lessons were developed following Gagne's (1985) hierarchy of learning prescriptions and the steps of the Dick & Carey's (2001) instructional design model. Formative evaluation was conducted through a workshop with 28 flight attendants while the summative evaluation, as prescribed by the model, was conducted with the lessons integrated into the work routines of a group of flight attendants at an international airline. This study employed the randomized one group pre- and post-test design. Stringent controls were put into place to mitigate the threats to the research design. The sample for the summative evaluation study consisted of 35 flight attendants and supervisors in five crews which were randomly assigned to the study by the airline's scheduling department. Three instruments were constructed to collect the data, namely the Usability Questionnaire, the Safety Achievement Test and the In-Flight Safety Assurance Questionnaire. The flight supervisors conducted the reflection and review activities within the pre-flight briefing sessions before each flight. Data were analysed using one-sample t-test for the mastery scores and independent samples t-test for self-efficacy scores. The moderator variable was gender. Stringent controls were put into place to mitigate the threats to the research design.

The findings showed that performance in Planned Emergency, Fire Fighting and First Aid increased significantly over the pre-test scores, and the mean post-test means were well above the 80% benchmark for mastery. An analysis of the scores based on the dimensions of intellectual skills also revealed significant improvements over the pre-test scores for discrimination, concepts, rules, higher-order rules, and also verbal information, with higher-order rules reporting the biggest improvement. The findings also showed that there were significant increases in self-efficacy with respect to Pre-Flight Briefing, In-flight Preparedness, and Expertise. Also, there were

no significant differences in mastery of safety knowledge and skills and self efficacy by gender. These findings suggest that the systematic interactive multimedia instruction courseware with reflection and review was effective in enhancing mastery in safety knowledge and emergency procedures among flight attendants and also their self-efficacy towards their duties.

Chapter One

Introduction

1.1 Background of the Study

Safety training is a major pillar in travel and tourism particularly in aviation sector. Therefore, in-flight safety assurance is a major concern for airlines and is considered to be the flight attendants' major responsibility onboard. Flight attendants take care of safety for millions of passengers annually and they are trained to take action when emergency situations arise onboard. Flight attendants safety training includes emergency procedures such as planned emergency, fighting fire, helping passengers in case of rapid decompression, the use of exits in case of emergency, and administering of first aid. The instructional methods provided for the flight attendants make use of text-based documents including description of the aircraft and emergency procedures. On the other hand, training flight attendants in the basic safety training and refresher training employs power point illustrations and text-based presentations in addition to practical drills through the facilities provided at the training center (JATS).

Within the current methods of training in most major commercial airlines, there are studies that shed light on deficiencies of flight attendants training. After reviewing the related literature in the field of flight attendants training, it was noticed that there is a lack of studies that address the context of the flight attendants' safety role onboard. Rhoden , Raltson & Ineson (2007) claim that:

> Ironically, the safety role of cabin crew (Flight attendants) receives no attention in the academic literature. Given that cabin crew take responsibility for millions of passengers annually, it is argued that the

> quality of the training delivered to enable them to undertake their safety role effectively is an important consideration for all air transport passengers and airline personnel (p. 538).

Lecouturier (1999) stresses on the importance of cabin safety for the global tourism industry since technological advancements have proved that air travel is more safe and survivable. He points out that the content and the quality of flight attendants' safety training is of critical importance. Therefore, the content and quality of the safety training delivered to cabin crew is of critical importance; but so far it is not analyzed in the academic literature. Rhoden et al (2007,) add that:

> *Consensus reveals that the official reporting of incidents is often forgotten, undertaken incorrectly or, in some cases, actively downplayed by airline managers who do not wish the airline to be notorious for disruptive passenger incidents* (p. 539).

Mahony, Griffiths, Larsen & Powell (2008) conducted a study on retention of safety knowledge and skills in first aid and resuscitation by airline cabin crew. The sample of the study consisted of 35 flight attendants. Of the 35 flight attendants 33 failed to use the bag-mask correctly; 18 performed chest compressions at the incorrect site; only 13 achieved the correct compression depth and 20 placed the automated external defibrillator (AED) pads correctly; the average time to first shock was 110 seconds after commencement of the resuscitation. The results of this study indicate that cabin crew may not have adequate training to manage a cardiac arrest properly. Mahoney et al pointed out that flight attendants were not able to carry out cardio pulmonary resuscitation (CPR) properly. Mahoney et al claimed that the lack of training is due to four reasons, the types of instructional techniques used, variations in

program delivery, time interval between training and retraining and lapses in knowledge and skill retention. Long time intervals between the refresher courses, that the flight attendants undergo every twelve calendar months, causes decay and weak retention of knowledge and skills due to lapses in human nature or human factor (Flight Safety Handbook, 2003; Adam, 2006), which might lead to the occurrence of incidents or accidents onboard (Mahony et al, 2008). The study by Mahony et al recommends that the current procedures of cabin crew training undergo investigation and modification. This study claims that the decline in cardiopulmonary resuscitation (CPR) and automated external defibrillator (AED) skills are associated with the types of instructional techniques employed, variations in program delivery and the time interval between training and re-assessment and lapses in knowledge and skill retention. Mahony et al recommended that frequent brief skill reviews be used through training technologies to improve retention of skills and this can be done before pre-flight briefing and the frequency of refresher course should be less than 12 calendar months.

Earlier, Phillips (1992) referred to a report by the National Transportation Safety Board (NTSB) which deals with investigation of 24 accidents. The report sheds light on the fact that flight attendants did not always follow emergency procedures, had difficulty locating and operating emergency equipment and sometimes failed to perform their safety duties in accordance with established criteria. Cushman (1992) in "Flight-Attendant Training on Safety is Faulted" pointed out that the National Transportation Safety Board (NTSB) reported that airlines are not adequately training flight attendants to handle emergencies such as evacuation. It is mentioned that the association of flight attendants added that it has long urged airlines to provide more thorough training. It is also pointed out that:

> *Although the airlines do give hands-on training in opening emergency exits and use simulators that can fill mock cabins with smoke, the report cited actual results in emergencies in concluding that the training may not be adequate* (p. 1).

Dunbar, Chute and Jordan (1997) conducted a study exploring the flight attendants technical knowledge and flight attendants and pilot expectations of flight attendants. The results of the study revealed that the flight attendants are not receiving adequate training according to the pilots' and flight attendants' expectations and the flight attendants are not trained on efficient exchange of safety information. They recommend that flight attendants training should be improved.

Chute and Wiener (1996) referred to cabin cockpit communication as crucial to the safety of the aircraft and its occupants. They gave example of the crash of Air Ontario F-28 on take off where 24 people were killed because of the accumulation of ice on the wings. Flight attendant Sonia did not communicate with the cockpit because she though that the cockpit are professional enough to deal with such issues. Chute points out that flight attendants do not communicate because of reasons like cultural directives, past experience and ambiguity of aviation rules. On the other hand, Bani Salameh, Abbas and Bani Salameh (2010a) explained the lack of proper communication on the part of flights attendants as due to different joint cognitive systems between cockpit and the cabin whereby flight attendants do not develop expertise safety schema because of inadequate training.

Chute and Wiener (1995) referred to lack of serious interest in flight attendants training that when the flight attendants threatened strike at a major carrier, the airline got approval from FAA to reduce training time for flight attendants from 6

weeks to 8 days. Still, the example of the heroic role by the flight attendants in the accident of the Hudson River, where US aircraft ditched into the Hudson River, reveals yet a positive picture of the flight attendants training. Leocha (2009) in "Unsung Heroes on the Hudson - Flight Attendants on US Airways 1549" points out that the actions of the flight attendants in the cabin were the key factor in the successful evacuation of the floating plane. Though there are reports of heroic acts and professional performance by the flight attendants in emergency situations, the previously mentioned studies continue to show weaknesses/lapses in actual abilities.

The current practice in all major airlines dictates that flight attendants must attend initial training to start their flight duties onboard and at the end of the year they should pass a recurrent training to be certified again to uphold their safety duties for the upcoming year. Flight attendant training includes safety training, security training and crew resource management (CRM) training both in basic training and the refresher training. CRM is defined as:

> *co-ordination of all the skills and resources, available to the crew, to achieve the established goals of a safe, efficient and comfortable flight.* (Royal Jordanian, 2007, p 3).

Vandermark (1991) pointed out that more than ten years ago most airlines did not include flight attendants in CRM training. Few airlines organized joint seminars including both flight attendants and pilots. And Chute and Wiener (1994) pointed out that Nationl Transportation Safety Board (NTSB) urged airlines to conduct CRM jointly for both cabin crew and cockpit crew. Bani Salameh et al (2010c) pointed out that even though flight attendants nowadays take CRM jointly with cockpit crew, studies and reports by Flight Safety Foundation Editorial Staff (2003, 2005), still

reveal lack of coordination and communication due to improper training among flight attendants.

However, currently CRM is a comprehensive system directed towards the entire crew including cockpit crew and other related staff and it aims at enhancing crew performance and it concentrates on crew attitudes, behaviours and the effect on safety. Bani Salameh, Abbas, Kabilan and Bani Salameh (2010c) claimed that retention of safety knowledge and skills among flight attendants can enhance crew resource management through creating expertise schema. CRM addresses five major issues: first, communication where by all the crew must establish effective communication when the need arise. Second, situational awareness which refers to the ability to develop a mental model of the current situation in addition to the ability to identify the place and what you need and finally the ability to take action therewith. Third, leadership is identified as the process of influencing the group to achieve the objective satisfactorily. Fourth, teamwork represents where a group of people work together in harmony to achieve the desired objective. Fifth, decision making and problem solving is the last component in CRM (RJ flight attendant in-flight safety manual, 2007).

Despite the fact that flight attendants go through CRM in the basic safety training and refresher training, there are still reports of flight attendants deficiencies. For example, Flight Safety Foundation Editorial Staff (2005) referred to a report by the captain on Boeing 757 when the supervisor committed a mistake by opening the door without taking permission from the captain. The captain said that someone could have been killed in the incident. The editorial staff also reported another incident when a flight attendant inadvertently deployed the slide raft in 2004 aboard A320.

Flight attendant safety training has been suffering inadequate attention (Rhoden et al, 2009; Mahony et al, 2008; Rosenkrans, 2006; Flight Safety Foundation, 2005; and Phillips, 1992). Therefore, this study sheds light on the context of flight attendant safety knowledge and skills (SKS) through constructing a cognitive model for flight attendants. Bani Salameh, Abbas, Kabilan, Leong and Bani Salameh (2009), in the IPS symposium of USM fellowship holders, proposed a model called the In-flight Safety Assurance model (ISA) figure (1.1) based on the general systems theory (Von Bertalanffy, 1962). ISA model was recognized by flight safety foundation (Bani Salameh et al, 2010a). In addition, Rosenkrans (2006) in AeroSafety World recognized the ISA model and its relevance:

> *Your discussion of how CRM, professionalism, expertise development, decision-making skills, cycles/loops of training and operational experience fit the proposed ISA model with the objective of developing ideal relationships and performance also should interest ASW readers* (p. 1) *(Appendix I).*

More details on the development of ISA model are provided in chapter two.

The essence of the model is that any given outcome such as expertise is the result of direct and indirect interactions or cause and effect relationships among many factors or elements and that the outcome is best understood when studied within the context of the factors and processes driving it. The In-flight Safety Assurance (ISA) model provides a holistic view of the quality assurance processes from initial training to refresher training and a closer look at the safety knowledge and skills (SKS) by the flight attendants in the various stages of their career. The factors of the ISA model represent the conceptual framework and the ideal practice of the flight attendants work routines in all major commercial airlines (Bani Salameh et al, 2010a).

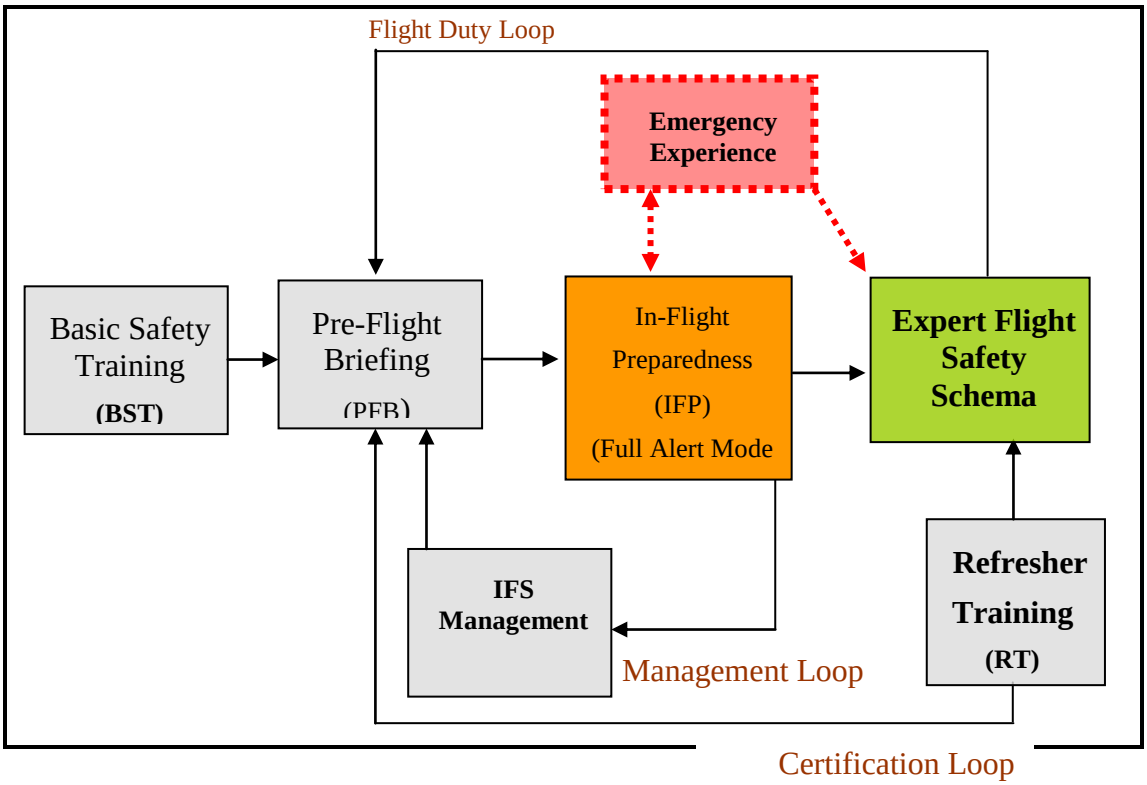

Figure 1.1: In-Flight Safety Assurance Model (Bani Salameh et al, 2009, 2010a)

The ISA Model consists of three loops: the duty loop, the certification loop and the management loop, with Expertise as a hypothesized outcome from the iterations within the loops. The first loop which is the focus in this research is called Flight Duty Loop, which includes PFB, IFP and the development of Expert Schema. The Flight Duty Loop is repeated approximately 10 times per month for twelve calendar months. Refresher training (RT) makes the second loop in ISA model, which includes RT, pre-flight briefing (PFB), in-flight preparedness (IFP) and Expertise. This loop is called Certification Loop because the flight attendants have to pass the refresher training (RT) in order to renew their annual competence certificate. According to ISA model, the newly recruited flight attendants have to sit for the basic safety training (BST) in the respective training centre where they receive all the safety knowledge and skills (SKS) as provided in the safety manual of the respective

airline. Passing the basic safety training course is the main requirement for the flight attendants to shoulder their safety duties onboard (Libean airlines Flight attendant In-Flight safety Manual, 2007). BST lasts four to six weeks, passing which qualifies the flight attendants to serve on as many as eight different planes (Cushman, 1992). Upon the completion of the BST, the flight attendants are provided with the safety manual which includes all the SKS in the form of printed texts and illustrations available in different sections. For example, specific information of the aircraft is provided in one section while the emergency procedures are provided in another section. The flight attendants have to carry the safety manual with them onboard and they must continuously refer to it during their career (Royal Jordanian Flight Attendant In-Flight Safety Manual, 2007).

Before each flight, the flight attendants must attend a pre-flight briefing (PFB) with the supervisor as a requirement to operate a flight. During the PFB, SKS competency is verified by the supervisor through the discussion of randomly selected topics for approximately ten minutes. PFB is a preplanning meeting to assure readiness of flight attendants for any emergency onboard (Koreltz-Elliott, 1989). A continuous assessment is established that for the flight attendants to do their job according to standards and procedures, they must be able to recall and reflect on the safety knowledge and skills during pre-flight briefing and to execute the required skills precisely when an onboard emergency arises (Royal Jordanian Flight Attendant In-Flight Safety Manual, 2007).

Onboard, the flight attendants must be fully prepared and alert to respond to any emergency situation that might arise during the flight; ISA model calls this phase In-Flight Preparedness (IFP). At this stage, the flight attendants are on standby mode and

they are expected to be fully alert and vigilant and use the SKS in solving any emergency situation when required.

The PFB and the IFP will be repeated for approximately ten times per month for twelve calendar months in an average movement of cabin crew in a major airline. Because of the BST and the rotation of both the PFB and IFP, the flight attendants are expected to develop expert schema, as proposed in the ISA model. Ericsson (2009) defines expertise as the personal qualities such as knowledge and skills that characterizes the expert as opposed to novice. Dreyfus and Dreyfus (1986) proposed a model for the development of expertise based on experience. The model included five stages of novice, advanced beginner, competent, proficient and expert. At the last stages of forming expertise, practitioners depend totally on intuition to solve the problem. Dreyfus and Dreyfus add that experts turn to be capable of critical reflection and self analysis. Gagne, Briggs and Wager (1992) referred to the events of instruction and systematic instruction as capable of transforming novice to experts through building experts schema. Lesgold et al (1988) claimed that practitioners develop expertise within specific domain through using the rules which creates a schema that guides decision making.

The last stage in ISA model is the refresher training (RT) which is taken only once every year and lasts for approximately 8 hours (Royal Jordanian Flight Attendant In-Flight Safety Manual, 2007); During the RT, the flight attendants refresh their memory with the major SKS topics in order to enhance their expertise memory and to reflect positively during PFB and IFP. Refresher training is different from basic training and it can be developed to maintain a good level of original training through using imaginary practice and symbolic rehearsal (Annet, 1979).

Intensive refresher training is recommended through the use of computers when it is difficult to make retraining specially for emergency situations that require errorless performance in real world experience. Refresher training is also needed, even if initial training is well designed, to maintain knowledge and skills during non-use periods and because training needs of retraining is different from new training (Druckman and Bjork, 1991). They argued that in terms of refresher training the training needs of retrainees are different from those of new trainees. They mentioned that relatively efficient and cost-effective techniques might be used to maintain a given level of original learning in retrainees. They added that retention might be enhanced through the use of computers in delivering instruction and diagnosing student progress in and out of the classroom.

In the study by Bani Salameh et al (2009) on 249 flight attendants in two major airlines an investigation revealed that the flight attendants and supervisors reported surprisingly low perceptions and self confidence and low self efficacy towards all the ISA factors and there were job and gender related significant differences where the flight supervisors were more concerned with IFP while the flight attendants were more concerned with PFB while male flight attendants reported higher preparedness for the safety knowledge and skills. Another interesting finding was that flight attendants who experienced onboard emergencies and successfully solved the emergency situations improved their perceptions and self confidence of the usefulness of the safety manual, the importance of PFB, and continuous mental practice and rehearsal. These findings showed that among flight attendants, experience was the better teacher and the safety knowledge and skills as well as the procedures to establish and maintain the SKS became meaningful and fully appreciated only after experiencing real-life emergencies. This is a very expensive

and risky way of maintaining expertise. This study suggested more realistic, practical and meaningful training packages are needed.

These findings are disquieting as they report the quality of engagement or the residual effects of each factor over a period of time and reveal the deterioration or uneven distribution of focus and levels of confidence among both male and female flight attendants and supervisors in assuring onboard safety. The low levels of self confidence and self efficacy and the uneven distribution of focus and confidence reported in this study should be seen as indicators of poor training or more accurately of poor maintenance of safety knowledge and skills (SKS) among the flight attendants. These findings can be interpreted as calls for help by the flight attendants and should be attended to immediately to avoid more negative findings such as reported by Bani Salameh, 2009), Mahony et al (2008), Rosenkrans (2006), Flight Safety Foundation, 2005, Phillips (1992) and Cushman (1992).

These findings are consistent with Rohden et al (2007) who reported that there was a lack of attention given to the needs of flight attendants. Mahony et al (2008) showed that time intervals and lapses of memory badly affected flight attendants' performance, and Phillips (1992) reported of accidents committed by flight attendants. The findings of these studies suggest that although flight attendants were trained and annually recertified to perform the safety procedures, the training and other activities that they underwent in the course of their careers were fragmented and focused on specific skills and behaviours, but not on the integration of safety knowledge and skills (SKS), nor for the development of expertise or expert schema. Flight attendants must be highly qualified and trained in order to be able to perform their duties properly when an emergency situation arises onboard. Deficiencies in

training might pave the way for accidents and loss of human life. Luxhøj and Maurino (2001) referred to Reason's model, which is adopted by the Federal Aviation Administration (FAA), Civil Aviation Authority (CAA), and Australian Bureau of Air Safety Investigation (ABASI). This model is called "An Accident Causal Chain" as in (Figure 1.2). It is used for investigation in aircraft incidents and accidents. Reason model is used to trace the causes or errors of accidents starting from the higher management to the whole sections of the airline. Luxhøj and Maurino described this model as a schematic interaction between individual error and implicit factors starting from the top level management. They pointed out that Reasons' model describes two interrelated aviation accident causal factors: (a) an active failure pathway that originates in top level decisions and proceeds through error producing situational factors at the workplace to unsafe acts committed by the individuals at the human-system interface and (b) a latent failure pathway that directly breaches the defences in a system. This research is concerned with the flight attendants who might turn to be one latent failure pathway which is the second causal factor in Reasons model.

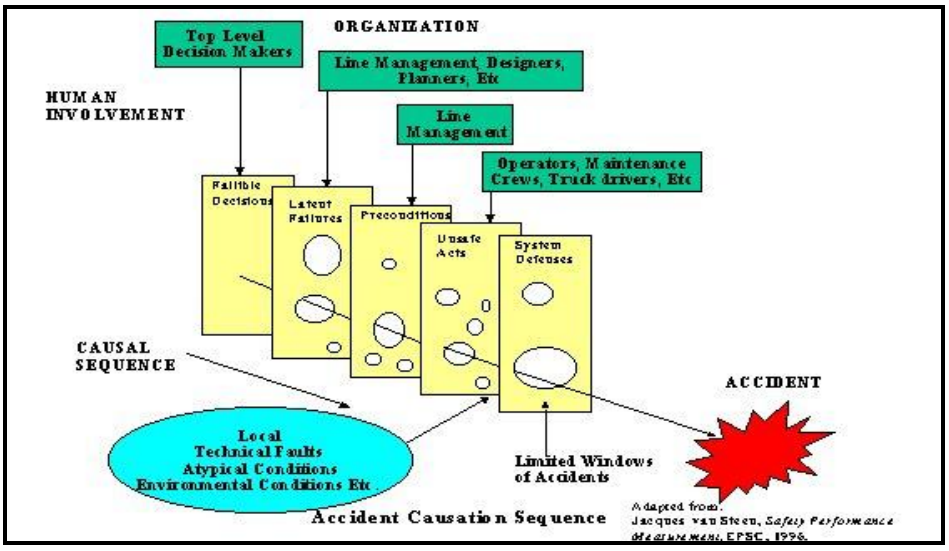

Figure 1.2: Accident Causal Chain Model (Flight Safety Handbook, 2003, P14)

Because of the previous studies that have suggested more training or the increase of the frequency of training and in order to detect and maintain the potential of incidents or accidents as implied in Reasons model, this research proposes the approach of continuous professional development (CPD) that holistically fulfils the requirements of training, frequency of retraining and continuous improvement of both male and female the flight attendants (Bani Salameh, Abbas, Kabilan & Bani Salameh, 2010c). White & Long (2003,) defined CPD as:

> *…the ongoing maintenance, acquisition and development of knowledge, skills and attitudes to enable an employee to constantly improve as a practising professional* (p 9).

They add that CPD implies self-directed and practice-based learning activities rather than supervised training and it aims at maintaining and developing competencies regarding knowledge, skills and attitudes of the individual to satisfy the needs of the industry as well as satisfying the need for personal professional development.

The ISA model specifies the flight duty loop, the management loop, and the certification loop that identifies three aspects of concerns for CPD. However the duties of flight attendants also include safety training, service training, security training and crew resource management training (CRM). There are many aspects for the full CPD activities but for this study the focus is on the improvement of one aspect which is the expertise of safety knowledge and skills (SKS) among both male and female flight attendants within the duty loop of ISA model. The development of expertise among flight attendants might be achieved by addressing the approaches that develop expertise or expert memory. Bransford, Brown, and Chocking (2002)

referred to three main approaches that help learners develop expertise: (a) meaningful learning and patterns, (b) organizing knowledge within a main domain, and (c) storing a big amount of knowledge about this specific domain. The use of multimedia, with its capabilities in providing text, sound, video, simulation, interactivity and animation in addition to adopting proper theory and systematic design of instruction could cater for the approaches that develop expertise or mental models (Johnson, 2009). Bani Salameh, Abbas, and Bani Salameh (2010a) argued that optimizing flight attendants safety knowledge and skills can enhance expertise among flight attendants. They claimed that the improvement of the SKS among flight attendants might be achieved through making use of computer-based training (CBT) with proper theory and systematic design of instruction. The use of computer-based multimedia training has been receiving much emphasis. Some studies have proved the capability of multimedia in knowledge and skills transfer (Bland and Leibowitz, 1995). Multimedia is defined as computer-based technology that makes use of text, graphic, animation, audio and video (Barron and Orwig, 1995).

On the other hand, this study investigates gender differences in safety knowledge and skills which might come out with new findings that might contribute to enhancing safety knowledge and skills (SKS) and enhance self-efficacy among flight attendants. In the 1980s, first flight attendants were females with a degree in nursing (Chute and Weiner, 1996). Currently, female flight attendants do not have necessarily to be specialized in nursing. Since both males and females pass through the basic safety training and refresher training, there is no need for specific background either for males or females (Bani Salameh et al, 2009).

1.2 Problem Statement

Studies and reports, such as by Mahony et al (2008), Rosenkrans (2006), Flight Safety Foundation (2005) and Philips (1992) reported on deficiencies and lack of confidence with regard to flight attendants' training and this inadequacy in training could pave the way for poor handling of incidents and accidents (Luxhøj and Maurino, 2001). Although the safety performance by the flight attendants in the Hudson River was outstanding (Leocha, 2009), the above mentioned studies and reports reported that flight attendants performance was below the standard. Poor training might be due to the lack of attention to cognitive task analysis (Bani Salameh, Abbas and Bani Salameh, 2010a).

Training of flight attendants is based on the flight attendant in-flight safety manual which is the only reference used after basic training and before refresher training. It is a text-based manual provided in a form of documentation. Moreover, the safety knowledge and skills for a given topic in the safety manual are presented in different and separate sections which poses the shortcoming of fragmentation. For example, it provides safety knowledge as specific information of the aircraft in one section and provides emergency procedures in another section (Libyan Airlines Flight Attendant In-Flight Safety Manual, 2007). Therefore, when a flight attendant needs to study planned emergency, for example, he has to refer to emergency procedures section to acquire the procedure. He also needs to move to the section of specific information of aircraft to recall the specific pieces of knowledge that are needed to perform the procedure.

Bani Salameh, Abbas and Bani Salameh (2010a), however, proposed that as the flight attendants are all certified professionals, the approach for training or retraining

should be conducted under the method of continuous professional development (CPD) which conforms to the nature of the flight duty loop in ISA model (PFB, IFP and Expertise). It could cater for the shortcomings of the human factor of knowledge and skills decay and the fragmentation of the ideas in the safety manual. Institute of Highway Incorporated Engineers (2006) identifies CPD as maintenance of knowledge, skills and development of positive attitudes towards the job. In this research, CPD might be achieved through making use of systematic interactive multimedia instruction (SIMI) and reflection and review (RR) for the flight attendants within the normal duty loops (PFB, IFP and Expertise) of the ISA model (Bani Salameh, Abbas, Kabilan and Bani Salameh, 2010c). CPD has been shown to be effective in enhancing knowledge and expertise in physical therapists and medical fields (Mowder-Tinney, 2008). CPD might overcome deficiencies reported to by the previous studies and the shortcomings of fragmentation and documentation of the safety manual and might also enhance Crew Resource Management (CRM) training through continuous maintenance, acquisition and development of SKS (White & Long, 2003) being provided through realistic authentic multimedia, systematic simulations and animation (Johnson, 2009) to train both air stewards and air hostesses (Bani Salameh et al, 2010).

Cornerstone (2005) proposes six indicators for effective continuous professional development (CPD), namely

1. Quality of information presented and demonstrated
2. Practice and feedback
3. Coaching and expert modelling
4. Collegiality
5. Organizational leadership, and

6. Administrative support (p. 1).

The first four indicators are relevant in the context of SKS for the Flight attendants. The quality of information presented and demonstrated relies on the use of technology in training based on proper theory and interactive multimedia instructional systematic design (ISD). The opportunity to engage in practice and feedback exists in CPD programs when the flight attendants have opportunities to practice their new skills through the interactivity and demonstration as presented in the nine events of instruction in Gagne's information processing theory (Gagne et al, 1992). This approach is different from the current method of assessment of flight attendants' safety knowledge and skills which are based on recall of facts and procedures that do not develop expertise schema (Bani Salameh Abass and Bani Salameh, 2010a). Gagne et al (1992) also proposed that human expertise can be analysed into verbal information which concerns with declarative knowledge and a taxonomy of intellectual skills which involves concepts, rules, problem solving and transfer of knowledge. Practice questions involving intellectual skills questions help participants better understand the skills and make new connections in pilot training research (Gagne et al, 1992). No study applying Gagne's ideas have been reported in the context of flight attendants except for the study by Bani Salameh Kabilan and Bani Salameh (2010b) whereby a multimedia English for Specific Purposes (ESP) program used Gagne's events of instruction in designing lessons for flight attendants. The traditional group used studied safety knowledge and skills in the traditional way. The results of the study proved significant for the sake of the experimental group who used the multimedia ESP program.

Cornerstone (2005) also listed activities that are particularly important in implementing coaching and expert modelling, namely, giving feedback selectively to support the use of new ideas, to build confidence and self-efficacy. The third indicator of coaching and expert modelling is represented through demonstration and simulation of the appropriate procedure in case of emergency situation onboard. The fourth indicator of collegiality is employed in this research through the discussion of the review and reflection scripts (Q & A) during PFB.

Systematic and interactive multimedia instruction (SIMI) and reflection and review activities (RR) can be designed to include all the four indicators. Studies of multimedia-assisted individual learning in academic contexts (Reilly and Spratt, 2007; Kaveevivitchai et al, 2009) support this contention. However, there are no studies in the contexts of safety training in general or in the contexts of safety training among flight attendants to support the use or non-use of extra coaching or discussion during the PFB. Thus, this study investigates the effects of the use of review and reflection (RR) activities after engaging with a systematic and interactive multimedia self-learning package on mastery of SKS and investigates flight attendants self-efficacy towards the dimensions of the duty loop (PFB, IFP and Expertise) in ISA model. It also investigates safety knowledge and skills and self efficacy among both male and female flight attendants. Gender was chosen as a moderator variable following Belenky et al's (1986) assertions that males and females employed different ways of knowing that might impact on the outcomes of this study. A study such as this is critical for the flight attendants as currently there is no such rigorous facility available for use in commercial airlines that could cater for the lapses of human memory as a human factor and the fragmentation in the safety manual.

1.4 Research Objectives

The research objectives in this research can be summarized in the following points:

1- Designing a multimedia training software that meets the theoretical requirements (cognitive processing and hierarchical structure), instructional systematic design principles (ISD) and cabin safety and usability standards.

2- Investigating the effects of the multimedia training package on overall performance and performance in planned emergency, fire fighting and first aid situations.

3- Investigating the effects of the multimedia training package on improving performance or mastery in discriminations, concepts, rules, higher order rules and verbal information.

4- Investigating the effects of the multimedia training package on improving self-efficacy towards the factors of the duty loop of the ISA model namely PFB, IFP and Expertise.

5- Investigating the effects of the multimedia training package on improving overall performance and performance in planned emergency, fire fighting and first aid situations by gender.

6- Investigating the effects of the multimedia training package on improving self efficacy towards the factors of the duty loop of the ISA model namely PFB, IFP and Expertise by gender.

1.5 Research Questions

Of the many topics in emergency procedures, literature on cabin safety sheds light on deficiencies with regard to SKS in planned emergency (Flight Safety Foundation, 2003), fire fighting (Rosenkrans, 2006) and first aid (Mahoney et al, 2008). Therefore, these topics are chosen for the study and the systematic interactive multimedia (SIMI) package was developed to deliver the lessons. In addition, this

study investigates the self-efficacy of flight attendants towards the duty loop in ISA model (Bani Salameh et al, 2009). Thus, the research questions are:

1. Does systematic and interactive multimedia instruction (SIMI) with reflection and review (RR) improve overall performance and performance in planned emergency, fire fighting and first aid situations?
2. Does systematic and interactive multimedia instruction (SIMI) with reflection and review (RR) improve performance or mastery in discriminations, concepts, rules, higher order rules and verbal information?
3. Does systematic and interactive multimedia instruction (SIMI) with reflection and review (RR) improve self-efficacy towards the factors of the duty loop of the ISA model namely PFB, IFP and Expertise?
4. Does systematic and interactive multimedia instruction (SIMI) with reflection and review (RR) improve overall performance and performance in planned emergency, fire fighting and first aid situations by gender?
5. Does systematic and interactive multimedia instruction (SIMI) with reflection and review (RR) improve self-efficacy towards the factors of the duty loop of the ISA model namely PFB, IFP and Expertise by gender?

1.6 Research Hypotheses

Based on the literature review that reports positive significant effects of using Gagne's events of instruction, multimedia, instructional systematic design model (Dick and Carey, (2001) and using reflection and review (RR) activities, the following alternative hypotheses were formulated and tested:

H1: The systematic and interactive multimedia instruction (SIMI) with reflection and review (RR) will significantly improve overall performance and performance in planned emergency, fire fighting and first aid situations.

H2: The systematic and interactive multimedia instruction (SIMI) with reflection and review (RR) will significantly improve performance or mastery in discriminations, concepts, rules, higher order rules and verbal information.

H3: The systematic and interactive multimedia instruction (SIMI) with reflection and review (RR) will significantly improve self-efficacy towards the factors of the duty loop of the ISA model namely PFB, IFP and Expertise.

Literature review regarding performance by gender in the use of multimedia lessons are mixed, namely, some studies reporting that there were significant differences by gender while others reported no significant differences. As such, the following null hypotheses were formulated and tested:

H04: There are no significant differences by gender in overall performance and performance in planned emergency, fire fighting and first aid situations after using the systematic and interactive multimedia instruction (SIMI) with reflection and review (RR).

H05: There are no significant differences by gender in self efficacy towards the factors of the duty loop of the ISA model namely PFB, IFP and Expertise after using the systematic and interactive multimedia instruction (SIMI) with reflection and review (RR).

1.7 Significance of the Study

First, this study promotes the concept of continuous professional development (CPD) which is the ongoing maintenance, acquisition and development of safety

knowledge, skills and attitudes (Bani Salameh et al, 2010a; White and Long, 2003) to enable an employee to constantly improve as a practising professional. The use of CPD might be accomplished through the use of educational technology as the delivery system. On the other hand, the use of systematic interactive multimedia instruction delivered through computer-based training (CBT) could increase mastery of safety knowledge and skills (SKS) and safety assurance with minimal effort and investment of time and money. Second, the use of instruction can be extended into handheld devices to be carried onboard to be reviewed after service and when needed. Third, this study caters for decay of SKS and which can reduce the need for providing other refresher training courses for flight attendants at short intervals (Mahoney et al, 2008). Fourth, this study also highlights the urgent need for training flight attendants through adopting proper instructional theories and instructional systematic design (ISD) principles by designing meaningful learning packages from the flight attendant safety manual (Bani Salameh et al, 2010c). Fifth, this study highlights the competitive advantage between airlines since in-flight safety is crucial to the survival of any airline. Finally, this study opens new avenues for improving cabin safety among flight attendants through adopting the approach of continuous professional development.

1.8 Research Limitations

Controlling the various aspects of the research is discussed in chapter three. In this section the research limitations are explained as follows:

1- In the pilot study the researcher and the briefing supervisor conducted briefing to the 28 flight attendants inside a room in the briefing centre. Then, the study of the SIMI with RR was through a form of workshop in five sessions. The 28 flight attendants were not assigned to normal flights as in the actual study. In the actual study the 35 flight attendants studied the SIMI before pr-flight briefing (PFB)

followed by RR during pre-flight briefing (PFB). The whole study was conducted within their normal flight duties. But they had to come to the briefing centre 20 minutes earlier than they used to.

2- During the actual implementation of the study the 35 flight attendants were not briefed all in one class room. Only the five in-flight supervisors were briefed by the researcher. Then, each flight supervisor briefed his/her crew separately in separate session before the actual implementation of the study.

3- The study of the SIMI followed by reflection and review (RR) during PFB was not administered for 35 flight attendants altogether. Rather, the five groups, each including one supervisor and 6 flight attendants, studied the program individually before PFB according to their scheduled flights.

4- Number of flight attendants in this study was 35 in one group. Generally speaking, flight attendants are always busy throughout the whole year and it is not possible to gather hundreds of flight attendants in one class. Therefore, this study was administered within the normal work routines of flight attendants and did not in any way hinder the normal duties of flight attendants.

5- Only one airline was involved in data collection in this study because both male and female flight attendants run through the same training and do the same duties in all major airlines.

6- No attention was given to demographic variations because it is impossible to take into account and will all consist of both young new flight attendants with little experience and those with lot of experience. Thus, the crew that is formed will always be composed of different ages, experiences and both genders.

7- The SIMI package was developed with reference to Airbus 320 aircraft but because the procedures are applicable to all aircrafts, the findings of the research can