

ATHABASCA UNIVERSITY

A COMPARATIVE STUDY OF MULTI-MEDIA ENHANCED DISTANCE  
EDUCATION AND CONVENTIONAL INSTRUCTION OF A CORE  
PARAMEDICAL PSYCHOMOTOR SKILL

BY

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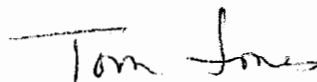
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fulfillment of the requirements for the degree of  
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# ATHABASCA UNIVERSITY

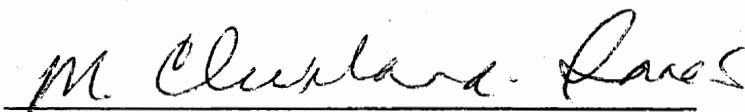
The undersigned certify that they have read and recommend to the Athabasca University Governing Council for the acceptance a thesis A COMPARATIVE STUDY OF MULTI-MEDIA ENHANCED DISTANCE EDUCATION AND CONVENTIONAL INSTRUCTION OF A CORE PARAMEDICAL PSYCHOMOTOR SKILL submitted by BARRIE MORRISON in partial fulfillment of the requirements of the degree of MASTER OF DISTANCE EDUCATION.



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## ABSTRACT

Emergency Medical Service (EMS) organizations are turning to distance education as an alternative to the traditional face-to-face classroom setting. EMS employees require a broad range of core competencies to perform their job effectively and the majority of these skill sets fall within the psychomotor domain of learning.

Traditionally these psychomotor skill sets have been taught in the classroom with an instructor providing a demonstration followed by coached practice and instructor feedback. The purpose of this study was to compare two types of instruction for a paramedical psychomotor skill: distance instruction versus face-to-face instruction.

The application of a pre-hospital fracture management device (Sager Traction Splint) was the psychomotor skill that was assessed. Forty-two recruits entering into the British Columbia Ambulance Service were randomly assigned into control and treatment groups and taught the application of the Sager Traction Splint by either a face-to-face or distance education instructional methodology. Results of student performance show that there was no significant difference in the effectiveness of either instructional method in teaching the psychomotor skill. Beneficial ramifications to EMS organizations as a result of this study could be cost savings accrued from using a distance education delivery model, as opposed to the face-to-face model, and more extensive access to consistent skill based training.

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# CHAPTER 1

## INTRODUCTION

Pre-hospital emergency medicine is a relatively new specialization within the general field of health care. It encompasses what has commonly become known as Emergency Medical Services (EMS). Generally speaking, EMS covers any treatment and or transport of the sick and injured prior to the patient gaining access to a primary treatment facility. EMS organizations vary in size and scope from small private businesses to large federally funded institutions. The levels of training and education for employees within the EMS field also vary considerably from basic life-support where students are taught fundamental first-aid skills, to advanced life-support where students are taught invasive emergency procedures.

Historically, education within the EMS field has been conducted in the classroom with some form of associated clinical practicum. Recently EMS organizations have started to examine distance education alternatives to their traditional methods of training delivery. Increasing costs associated with face-to-face instruction, access to instruction, and economies of scale are some of the reasons behind this movement.

The work environment for EMS employees is often stressful, chaotic, and unstructured. This requires workers to have competency-based skill sets to be able to function effectively in the pre-hospital setting. Cognitive and affective domains of learning do play a role but for the most part psychomotor skills forms the basis for the EMS employee competencies. Psychomotor skills that are required by the paramedic in the field have historically been taught by the “expert as model” method.

Typically, this would call for an instructor to demonstrate, to describe in detail the skill and its sub-competencies, and finally to provide opportunities for practice with appropriate feedback.

The continued advances in technology have allowed for further flexibility and refinement of distance education delivery methods. Information can now be represented and accessed in a variety of ways to engage the distance-learning student. The framework for this study involved a multi-media (digitized print, audio, and video) lesson plan that utilized the Internet, the World Wide Web, and CD-ROM technologies.

The objective of the study was to compare the effectiveness of two instructional methods, conventional face-to-face instruction and distance instruction, in teaching a core paramedical psychomotor skill.

## THE PROBLEM

### RATIONALE FOR THE STUDY

Emergency Medical Service (EMS) organizations, as well as many other post secondary institutions, are turning to distance education as an alternative to the traditional face-to-face classroom setting. EMS employees require a broad range of core competencies to perform their job effectively and the majority of these skill sets fall within the psychomotor domain of learning. If it could be shown that distance education, enhanced with multi-media technology, is as effective or more effective

than the current face-to-face delivery methodology, this would prove to be valuable to the future of EMS education.

## THEORETICAL FRAMEWORK

Medical education learning theory is eclectic in nature. One of the characteristics of medical knowledge is that it is immense and constantly changing. It is virtually impossible for students to learn all there is to know about health care. There is a trend to move to learner-centered education involving problem-based learning, reflective practice, experiential learning, and case studies. In spite of this, the fundamental skills required by health care professionals, regardless if one is a physician, nurse or paramedic, are based on core psychomotor skill sets.

The focus of this thesis was grounded on learning theory as put forth by Bloom and Krathwohl (1956) and further refined by Simpson (1972). Bloom and Krathwohl developed three overlapping domains of learning: cognitive, affective, and psychomotor. This study focused on the psychomotor domain. Psychomotor learning is demonstrated by organized patterns of muscular activity such as coordination, dexterity, manipulation, strength, and action. Psychomotor skills can be further divided into fine motor skills that require delicate and precise movements and gross motor skills that encompass less refined and less precise muscular movements. Simpson later expanded Bloom and Krathwohl's original work by developing specific categories of psychomotor skills based on their complexity. Simpson also developed corresponding behavioral terms to match each category on his skill development continuum. This study utilized Simpson's categorizations of psychomotor skills in determining the effectiveness of instruction.

## STATEMENT OF THE PROBLEM

Can paramedical psychomotor skills be effectively taught via distance education? A typical response when you pose this question to EMS instructors is “no”. Comments include “Nothing is better than a live demo”, “Face to face interaction is crucial”, and “Feedback and coaching directly with the student makes all the difference”. Are these anecdotal comments factual or is it possible to teach psychomotor skills without an instructor being present? If the answer were “yes”, this would have far reaching consequences not only in the field of pre-hospital medicine but also in any field where skills and competencies are being taught using a face-to-face format.

This study examined the degree of student achievement on predetermined competencies to determine effectiveness of instruction. Specifically, could a set of instructional sequences that were designed specifically for distance education, to teach an isolated paramedical skill set, be as effective as a traditional instruction system designed to demonstrate, to describe, to coach and to practice in a face-to-face format?

## HYPOTHESIS

There would be no significant difference in the effectiveness of multi-media enhanced distance education and conventional instruction of a core paramedical psychomotor skill.

## LIMITATIONS

The sample of 42 subjects was obtained from recruits entering into the British Columbia Ambulance Service (BCAS). These recruits met the minimal hiring

requisites for BCAS but there was no control over prior learning or knowledge on fracture management traction devices. If students had used the traction device used in the research, then they were eliminated from the study. However, there are a wide variety of fracture management traction devices on the market so some prior knowledge/skill may have been acquired.

### DELIMITATIONS

The number and the rate of recruits entering the British Columbia Ambulance Service limited the sample size. A six-month time frame was chosen which resulted in 42 subjects.

To allow for inter-rater reliability, video cameras were used on all evaluations. The use of video cameras for evaluations was a new experience for the sample students; however, video cameras are used in other parts of their training and evaluation. Sample participants were told that the use of video cameras would be something to expect from that point in time in future training and evaluation.

Maintaining a separation and controlling access to the distant education lesson plans between the experimental and control sample groups posed a challenge. A designated web site on the Internet contained instructional materials that all students in the study had password access to. The technology that was used to teach the multi-media enhanced distance education was a hybrid CD-ROM. Students in the study needed both the CD-ROM and access to the Internet to view the full lesson plan. The web site allowed access to only the digitized text materials and the CD-ROM allowed access to the audio, graphics, and video portion of the lesson plan. In other words, even though all students involved in the study could

gain access to the web site, by restricting the distribution of the CD-ROM, the material on the web site was useless.

### DEFINITIONS OF TERMS

BRITISH COLUMBIA AMBULANCE SERVICE. A branch within the provincial ministry of health responsible for ambulance services within the province of British Columbia.

CRITERION-REFERENCED EVALUATION. Objective assessment of skill specific criteria.

DISTANCE EDUCATION. An educational process where there is separation between the teacher and learner (Keegan, 1996).

JUSTICE INSTITUTE OF BRITISH COLUMBIA. A post-secondary institution with a mandate to train people working in the areas of justice, public safety, and human services.

PARAMEDIC. A health care professional with the skills and abilities to provide pre-hospital care to the sick and injured.

PARAMEDIC ACADEMY. A division of the Justice Institute of British Columbia.

PARAMEDIC LEVEL-ONE (P-1) PROGRAM. A paramedical program recognized by the Paramedic Association of Canada (PAC) and accredited by the Canadian Medical Association (CMA). The program is offered through the Justice Institute of British Columbia.

PARAMEDIC TRAINING NETWORK (PTN). A distributed learning network of 15 satellite Paramedic Academy training centres linked together with 180 British

Columbia Ambulance Service stations used to deliver training to the paramedics of British Columbia.

SAGER TRACTION SPLINT. A patented fracture management device used to immobilize lower extremity fractures.



## CHAPTER II

### REVIEW OF THE LITERATURE

The purpose of this study was to do a comparative analysis between two instructional methodologies to determine the effectiveness of instruction on a psychomotor skill. The two instructional methodologies were multi-media enhanced distance education and face-to-face instruction. Criterion-referenced competency-based evaluations were used to determine student performance. This chapter reviews the literature covering the following: a perspective on comparative studies examining the effectiveness of distance education in relation to traditional face to face instruction, the adult learner, measuring the effectiveness of instruction, the psychomotor domain of learning, and the use of criterion-referenced competency-based evaluations. The final section looks specifically at literature that deals with comparing distance mediated instruction and traditional classroom instruction to teach medical related psychomotor skills.

#### COMPARATIVE RESEARCH IN DISTANCE EDUCATION

Much research in education has focused on comparing distance education with traditional classroom education. Russell (1999) has compiled a book with 355 bibliographic entries of research reports, summaries and papers all in connection with comparing the effectiveness of distance education with face-to-face instruction. All of Russell's entries have suggested that there was no significant difference in student performance for distance education and traditional education. Phipps and Merisotis (1999) questioned the legitimacy of some of the research methodologies used by many of the works cited by Russell but regardless there is still ample

evidence demonstrating the effectiveness of distance education. Rekkedal (1994) suggested research in distance education is a developing field with more distance educators taking part in theoretical and practical research than their counterparts in the traditional mainstream of education. One of the reasons for this, as implied by Rekkedal, is the need to develop and demonstrate quality, because distance education has often been considered by the traditional academic community to be some kind of second-rate education. Saba (2000) downplayed this notion by suggesting that although distance education “researchers continue to conduct comparative studies, their usefulness in revealing more information has diminished over the years; invariably, they have returned a “no significant difference” result between various forms of instruction” (p.1). Wetzel, Radtke, and Stern (1994) agreed that comparative studies of distance education and classroom instruction showed no statistically significant difference. Machtmes and Asher (2000) confirmed these previous conclusions that “there does not appear to be a difference in achievement between distance and traditional learners” (p. 43).

Of significance to this study was the lack of research in the literature on comparative analyses of teaching psychomotor skills via distance education. The majority of research was in the cognitive and affective domains of learning. Phipps and Merisotis (1999) stated that over 60 percent of distance education courses at the academic undergraduate level dealt with liberal arts courses such as humanities, social sciences, math and science with the remaining percentile falling into business, computer science, and education. At the graduate level, over half the courses dealt

with education with the remaining falling into social sciences, business and math science.

### THE ADULT LEARNER

The context for this research proposal was an adult learning environment. Having a general understanding of how and why adults learn was useful in determining the effectiveness of instruction in relation to student performance. Knowles's (1975,1984) theory of andragogy is an attempt to develop a theory specifically for adult learning. Knowles emphasized that adults are self-directed and expect to take responsibility for educational decisions. There are 4 main components to Knowles's theory:

- Adults need to know why they need to learn something.
- Adults need to learn experientially.
- Adults approach learning as problem solving.
- Adults learn best when the topic is of immediate value.

In practical terms, andragogy means that instruction for adults needs to focus more on the process and less on the content being taught. Strategies such as case studies, role-playing, simulations, and self-evaluation are the most useful. Instructors can take on more of a role of facilitator rather than lecturer. Pratt (1993) expands by suggesting that adult learners are autonomous by nature, desire self-improvement and have a capacity for self-direction. Many authors (Caffarella, 1993; Garrison, 1992; Grow, 1991; Hiemstra, 1993) have added to the adult learning theory of self-directed learning, emphasizing that the process of learning, which is centered on learner need, is more important than the content. Candy as cited in Tennant and

Pogson (1995) argued that self-directed learning “embraces four distinct phenomena: personal autonomy, the willingness and capacity to manage one’s own learning, an environment allowing effective control by the learner, and the independent pursuit of learning without formal institutional support or affiliation” (p.122).

Having a clear understanding of adult learning theory assisted in analyzing instructional system design, learner needs, and affective behavior towards distance education in general.

### EFFECTIVENESS OF INSTRUCTION

It is important to point out that the purpose of this study was to compare two instructional methodologies in teaching psychomotor skills and to determine if one was as effective as the other. This study did not try to demonstrate that the media alone influences learning outcomes but that media as part of an instructional system, in this case a distance education format enhanced with multi-media technology, could be as effective as a face-to-face classroom setting. Clark (1994) argued just that when he stated “media per se do not influence learning...rather learning is caused by the instructional methods embedded in the media presentation” (p. 26). Kozma (1994) opposed Clark by suggesting that instructional methods and media are purposefully intertwined in the instructional design process and that one component influences the other. In general terms, the question becomes: what teaching strategies, techniques, or devices contribute most effectively to student learning (O’Neill, 1988)? Omoregie (1997) listed variables that could influence the effectiveness of instruction, many of which tie into the previous section on the

theories of adult learners. These variables include: age, gender, environment, educational level, life experiences, motivation, and cognitive style. Fulford and Zhang (1993) contended that student interaction plays a key role in determining learner satisfaction, which in turn affects teaching effectiveness. Hackman and Walker (1990), when discussing distance education agreed by suggesting effectiveness depends on learner satisfaction, since learners ultimately decide whether the trade-offs in a distance setting are worthwhile. Finally, Ryan, Carlton, and Ali (1999) also conducted a study to determine effectiveness of instruction based on student perceptions comparing traditional classroom delivery with a distance education format. They concluded that in the classroom setting, students perceived that the content was covered more adequately and that there was more interaction and participation whereas in the distance education students mentioned that they felt disconnected from their class members and that feedback was not always clear.

This study focused on performance outcomes. Could the students achieve mastery of a set of psychomotor skills as effectively through distance education as they can through the traditional face-to-face classroom? As such, emphasis was placed on evaluation results to determine teaching effectiveness as opposed to student satisfaction of the instruction.

### PSYCHOMOTOR DOMAIN OF LEARNING

Bloom and Krathwohl (1956) developed a classification of levels of intellectual behavior important in learning, which has since become known as Bloom's taxonomy of learning. Bloom's classification described three overlapping levels of

behavior: cognitive, affective, and psychomotor. Bloom and Krathwohl simply defined psychomotor learning as the demonstration of physical skills, coordination, dexterity, manipulation, strength or speed. Subsequent authors have further refined and extended Bloom's original work in the psychomotor domain. Dave (1970) for example, further subdivided the psychomotor domain into five levels:

- Imitation (observing and patterning behavior after someone else).
- Manipulation (being able to perform certain actions by following instructions and practicing).
- Precision (refining and becoming more exact).
- Articulation (coordinating a series of actions, achieving harmony and internal consistency).
- Naturalization (having high level performance become natural, without needing to think much about it).

Harrow (1972) also categorized Bloom's psychomotor domain as the following:

- Reflex.
- Fundamental movements (crawl, run, jump, reach).
- Perceptual abilities (catch, write, balance, distinguish).
- Physical abilities (stop, increase, move quickly, change, react).
- Skilled movements (play, hit, swim, dive, apply, use).
- Non-discursive communication (express, create, mime, design, interpret).

Simpson (1972) broke down Bloom's psychomotor domain into seven levels.

Simpson also developed corresponding behavioral terms that would match each category on the psychomotor skill development continuum to assist instructors in

developing learning objectives. In the context of this thesis, it was worth examining Simpson's extrapolations further because the performance criteria to demonstrate the psychomotor skill in the experiment were based on specific instructional objectives. For example, students were expected to apply a fracture management traction device (Sager Traction Splint), which involved psychomotor actions such as: explain, apply, position, size, place, slide, inform, secure, pad, check, fasten, choose, and select.

Table 1. Major categories in the Psychomotor Domain (Simpson's Taxonomy)

<u>DESCRIPTION OF CATEGORY</u>	<u>BEHAVIORAL TERMS</u>
<u>Perception</u> (the ability to use sensory cues to guide motor activity)	chooses, describes, detects, distinguishes, identifies, isolates, selects
<u>Set</u> (refers to the readiness to take a particular course of action)	Begins, displays, moves, proceeds, explains, shows, states, volunteers
<u>Guided response</u> (refers to imitation and trial and error in which the adequacy of the performance is judged by a defined set of criteria)	Copies, traces, follows, react, reproduce, responds
<u>Mechanism</u> (describes learned responses that have become habitual)	assembles, builds, constructs, applies, dismantles, displays, fastens, fixes, mends, organizes, calibrates, measures
<u>Complex overt responses</u> (is a skillful performance that involves complex movement patterns. Proficiency is indicated by a quick, accurate, and highly coordinated performance. In this category, responses are automatic)	assembles, builds, constructs, applies, dismantles, displays, fastens, fixes, mends, organizes, calibrates, measures
<u>Adaptation</u> (skills are so well developed that the individual can modify movement patterns to fit special requirements or to meet a problem situation)	Adapts, alters, changes, rearranges, reorganizes, varies
<u>Origination</u> (is the creation of new movement patterns to fit a particular situation. Outcomes at this level emphasize creativity based upon highly developed skills)	arranges, composes, designs, creates, initiates, makes

Behavioral psychologists such as Skinner (1971) emphasized practice, part versus whole task learning, and the importance of instructor feedback and reinforcement in learning psychomotor skills. Mareniuk (1976) also stressed the importance of instructor feedback and pointed out that to improve the learning of psychomotor skills it helps to slow the rate of presentation and to reduce the amount of information that needs to be processed. Singer's (1975) research furnished evidence to support the importance of feedback and guidance from the instructor. The distance education multi-media lesson plans that were used in this experiment did not provide any direct instructor feedback to the students.

It is clear that instructional design plays a critical role in determining the effectiveness of instruction and the performance outcomes of students trying to master psychomotor skills via distance education.

### COMPETENCY-BASED EVALUATION

Competency-based training and competency-based assessment are important trends in vocational training (Hall, 1994) and are often driven by strong political impetus as the way to prepare students for the work force and the global economy (Kerka, 1998).

Assessing competence is an elusive task. Objective criterion-referenced checklists are often used to assess competency but the interpretations or standards of acceptable performance are subjective. Collins (1983) an opponent of competency-based training and evaluation contended that competency-based training suffers from excessive reductionism. In other words, trying to explain



complex phenomena by discrete, standardized concepts is next to impossible to do. Collins suggested that the behaviorist approach to learning skills ignore the social constructions of adult learning theory. A broader approach to competency was taken by Gonczi, as cited in Kerka (1998) who sees competence as a complex combination of knowledge, attitudes, skills and values demonstrated in the context of task performance. This approach acknowledges levels of competence from beginner to expert.

One of the main arguments for the use of competency-based assessment is that it measures performance standards for workplace readiness and consequently satisfies employer's needs for a skilled workforce. The concern comes in determining performance standards and then ensuring inter-rater reliability in assessment. Observer disagreement can lead to a biased assessment. Moore and Young (1997) recommended that assessors should be trained, and criterion-referenced discrepancies discussed prior to evaluation. Consistency in evaluation is the key.

#### RESEARCH LITERATURE SPECIFIC TO THE PROBLEM

Williams (1992) conducted a comparative study in which traditional in-classroom instruction was compared to instruction via broadband video conferencing in the teaching of cardiac arrest skills to paramedics. Williams's research design was similar to the one used in this study. Subjects were randomly chosen, half the group had face-to-face instruction while the other half had instruction delivered by video conferencing. Both groups received two hours of skills instruction on defibrillation and intubation in a cardiac arrest scenario. Student performance was assessed by

evaluators using criterion-referenced evaluation checklists. Williams's analysis showed that "there was no difference in performance of the two skills between those who received in-class instruction and those who received instruction through video conferencing" (p.123).

Aukerman (1986) conducted an experiment to validate a specific interactive video teaching methodology for teaching Cardio Pulmonary Resuscitation to Registered Nurses. Again, a similar research design was used to that of this study; a traditional classroom setting of lectures and demonstrations was compared to students being taught utilizing technology enhanced distance education. The American Heart Association criterion-referenced standards were used for evaluation. Aukerman concluded by stating that, "there was no significant difference found in knowledge or skill test scores between participants of the two teaching methods" (p.67).

Baldwin, Hill, and Hanson (1991) found that face-to-face faculty contact with students is an important factor when students are learning to perform a basic psychomotor skill. Their study focused on the ability of students to perform the psychomotor skill of manually obtaining a patient's blood pressure with a stethoscope and sphygmomanometer. This psychomotor skill was similar to the application of a Sager Traction Splint.

Bazyk and Jeziorowski (1989) also conducted a comparative analysis between a live instructor demonstration of a psychomotor skill and a remote presentation of the same skill with no face-to-face contact. Their results showed no significant difference in student achievement; however, they concluded that students

prefer the face-to-face interactions with a live instructor to the remoteness of distance education.

### SUMMARY

There is substantial literature on research that has been done on comparative studies between traditional face-to-face instruction and instruction that occurs via distance education but Phipps and Merisotis (1999) warned that these studies need to be viewed with skepticism, as the quality of research was questionable. The population for research was adults. Adult learning theory was important in understanding the psychomotor learning domain as well as in determining the effectiveness of instruction. Competency-based assessment was used to determine student performance. Objectivity, fairness, and consistency were factors that needed to be addressed to ensure inter-rater reliability.

Specific research examining the effectiveness of distance mediated learning in teaching psychomotor skills in the health care field shows no significant difference in student performance than that of traditional face-to-face education. This previous research tended to focus on video conferencing or interactive television. Today educational technology has advanced to the point where multi-media enhanced distance education is accessible for students and economically feasible for organizations. The CD-ROM technology that was used in this study allowed for unprecedented student interaction in teaching paramedical psychomotor skills at a distance. By building on previous research, this study assisted in determining if paramedical skill sets could be exclusively taught via distance education.

## **CHAPTER III**

### **RESEARCH PROCEDURES**

#### RESEARCH METHODOLOGY

An experimental, post-test only, group comparison design of two different instructional methodologies was used. Subjects were chosen and then randomly assigned for both treatment and control groups. The control group was taught a core paramedical skill set using a traditional face to face “demonstrate, describe, practice” instructional methodology while the treatment group was taught the same paramedical skill set using only multi-media enhanced distance education. For both groups, each subject’s performance was videotaped and then evaluated using criterion-referenced checklists. The performance achievement of both groups was subjected to a comparative analysis.

#### SPECIFIC PROCEDURES

Permission to conduct the research was obtained from the British Columbia Ambulance Service’s Director of Medical Programs and endorsement from the Justice Institute of British Columbia, Paramedic Academy, was granted. Approval from the University of Athabasca Research Ethics Board was obtained. Individual subject consent forms were developed and signed by all participants (Appendix A).

The Paramedic Academy, an academy within the Justice Institute of British Columbia has established, in conjunction with the British Columbia Ambulance Service (BCAS), a distributed learning network for the paramedics of British Columbia. This distributed learning network, entitled the Paramedic Training

Network (PTN), links 15 satellite Paramedic Academy campuses to the main Paramedic Academy campus, which is located within the Justice Institute of British Columbia in New Westminster, British Columbia. Also linked within the PTN are 180 British Columbia Ambulance Service (BCAS) stations. Each ambulance station has one, two, or three computers depending on the size of the staff attached to that particular ambulance station. Each computer has CD-ROM/DVD capabilities and Internet access. Each of the 15 satellite training regions has a Regional Training Coordinator whose primary role is to coordinate and deliver instruction to paramedics within their region.

Specific training was provided to the Paramedic Academy's Regional Training Coordinators to inform them of the experiment and to review their roles and responsibilities within the experiment. The general responsibilities for the Regional Training Coordinators included the face-to-face instruction of the control group, the videotaping of student performances for both the control and treatment groups, and the logistical considerations of tracking, labeling, and shipping of videotaped assessments. Training was also given to the Regional Training Coordinators to ensure consistency in the experimental process. This involved a review of the current lesson plans being utilized for the face-to-face instruction, expectations and instructions on videotaping the evaluations, and their logistical responsibilities to the research project.

The psychomotor skill set that was the focus of this experiment involved the application of a fracture management device called the Sager Traction Splint. This is a patented immobilization device used primarily in the pre-hospital setting to splint

lower extremity fractures, specifically femur, knee, tibia and fibula injuries. The instructional methodologies used to teach the proper use of the Sager Traction Splint are discussed further in the Instrumentation section.

A second group of volunteers that required training were the evaluators. This was a group of three people who were responsible for watching the videotaped performances of all the subjects and then evaluating each subject's performance. Training focused on inter-rater reliability and occurred prior to the data being collected. Criterion-referenced checklists (Appendix B) were used to determine acceptable or unacceptable student performance and each evaluator was given a detailed performance guideline on what constituted an acceptable or unacceptable behavior on each psychomotor step in applying the Sager Traction Splint (Appendix C)

A communication protocol was established. An introductory and explanatory letter along with procedural guidelines was sent to all Regional Training Coordinators (See Appendix D). Communication also occurred via telephone and email between the researcher, the sample population, and the Regional Training Coordinators.

Experimental controls had to be put into place. Prior to the experiment, the Sager Traction Splint CD-ROM lesson plan that was used, in part, to instruct the multi-media component of the experiment (See section on Instrumentation) was already in existence. That meant that access to the CD-ROM lesson plans had to be restricted. Prior to the experiment, the CD-ROM lesson plan and general course Study Guides were distributed to all new students. As well, students were told that

the multi-media presentation materials were available but optional. This posed a problem. Communication with and cooperation from the Regional Training Coordinators was required to limit distribution of the multi-media CD-ROM lesson plan to those students in the treatment group. In other words, the control group did not have access to the CD-ROM lesson plan and instruction for them came solely from face-to-face instruction. In addition, students in the control group were contacted personally by each Regional Training Coordinator and asked verbally not to use or view the multi-media CD-ROM lesson plan. This had to be done because co-workers who have previously taken paramedical training may have inadvertently offered to lend the new students the CD-ROM lesson plan. The lesson plans for the face-to-face instruction have been in use for a number of years; however as mentioned above, training was provided to the Regional Training Coordinators to ensure consistency of instruction.

Timelines were established for the experiment. The British Columbia Ambulance Service is constantly hiring new recruits all across the province. Once hired, these employees enter into training with the Paramedic Academy. The entry-level or Paramedic Level-One (P-1) program is comprised of eight courses with a combination of independent computer-based training, regionalized face-to-face workshops, hospital clinical time, and on-car practicums. For the purposes of this study, only the independent computer-based training and the face-to-face workshops were of relevance. Students are typically given four weeks to work on their independent computer-based training prior to attending regionalized three-day workshops. At the workshops students have access to instructor demonstrations,

hands-on practice, and peer feedback. Competency-based evaluations also occur at workshops. For this study, students were notified by the British Columbia Ambulance Service's Human Resources department that they were to start training in the Paramedic Level-One (P-1) program. At the first regionalized workshop, Fundamentals 110, students were notified about the experiment. Then following four weeks of independent study, which for the treatment group included the multi-media enhanced CD-ROM Sager Traction Splint lesson plan, students were evaluated on the Sager Traction Splint at the next regionalized workshop, Core Skills 111. In other words, the treatment group received their independent materials supplemented with the multi-media CD-ROM Sager Traction Splint lesson plan while the control group simply received their independent study materials with no references to the Sager Traction Splint. The control group was then taught the Sager Traction Splint during the face-to-face workshop using the traditional method of lecture, demonstration, and student practice before being assessed on their performance. All student performances for both the treatment and control groups were videotaped. The Regional Training Coordinators were responsible for videotaping the evaluations and the logistics of tracking, labeling, and sending the videotapes back to the researcher. The researcher then catalogued the videotapes and sent them to the three specially trained evaluators for marking. These evaluators used criterion-referenced checklists and were unaware of the instructional methodology that was used to instruct the student on the Sager Traction Splint.



Data collection occurred over a six-month period. This corresponded to the number of British Columbia Ambulance Service recruits entering the Paramedic Level-One program required to meet the sample size.

### SAMPLE

The British Columbia Ambulance Service hires approximately one hundred new part-time recruits every year. These recruits were the population from which the sample was drawn. These employees are expected to participate in the entry-level Paramedic Level-One (P-1) program offered through the Justice Institute of British Columbia, Paramedic Academy. A sample of these new recruits was taken over a period of six months to give a sample size of forty-two students. The sample was selected with information obtained from British Columbia Ambulance Service's Human Resources department and student registration at the Paramedic Academy. Justification for choosing the sample was that this group of employees had limited exposure to paramedical training, specifically to the psychomotor skill set that the study was examining. Additionally, new recruits to the British Columbia Ambulance Service must have a prerequisite basic first-aid course prior to being hired; however the Sager Traction Splint is not part of a basic first-aid course curriculum.

This group of employees was representative of new recruits entering the British Columbia Ambulance Service given the current hiring requisites of age, education, physical fitness, and qualifications. The British Columbia Ambulance Service provides pre-hospital care services to all regions of the province: isolated rural areas and densely populated urban areas. Therefore the British Columbia

Ambulance Service itself would be representative of Emergency Medical Service organizations.

The 42 recruits were then randomly assigned to either the control or the treatment group with 21 students in each group. The control group was taught the Sager Traction Splint using the traditional face-to-face instructional methodology while the treatment group was taught the Sager Traction Splint solely with a multi-media enhanced distance education lesson plan with no face-to-face instruction. The division into the two groups was done using a random cluster method. In other words, the sample of recruits was clustered according to their respective regional training centres. Then the fifteen regional training centres were chosen randomly to decide which cluster of students would be in the face-to-face or multi-media groups. See Table 2 for the distribution of the sample population.

Table 2. Distribution of sample population

Community	Multi-Media or Face-to-Face	Number of Students
PRINCE GEORGE	Multi-Media	4
CAMPBELL RIVER	Multi-Media	6
VICTORIA	Multi-Media	6
SMITHERS	Multi-Media	5
CRANBROOK	Face-to-Face	8
TERRACE	Face-to-Face	8
DAWSON CREEK	Face-to-Face	5

Access to the sample population and subjecting the students to the experiment presented no problems with the British Columbia Ambulance Service or the Paramedic Academy, as both agencies had an invested interest in proving or disproving the effectiveness of multi-media enhanced distance education in teaching paramedical core skills.

## INTRUMENTATION

This experiment examined the effectiveness of two different instructional methodologies; traditional face-to-face instruction and multi-media enhanced distance education to teach a core paramedical psychomotor skill set. This section examines the assemblage of techniques, apparatus, tests, technology, and questionnaires that were used in this study.

CD-ROM TECHNOLOGY. Employees of British Columbia Ambulance Service participating in training have access to personal computers and Internet service providers in each ambulance station in the province. The multi-media distance-learning lesson plan that was used to instruct the subjects of the study was partially contained on a hybrid CD-ROM, meaning that, students had to use the CD-ROM in conjunction with the Internet to obtain all the information. Textual information is provided via the Internet and the CD-ROM provided detailed graphics, audio, and video. The rationale behind using hybrid CD-ROM technology was the lack of speed and or bandwidth of many Internet service providers across the province of British Columbia. The multi-media distance-learning lesson plan was broken down into learning objectives so that the student could learn the psychomotor skill, in this case the application of the Sager Traction Splint. The multi-media lesson focused on a particular set of procedures, skills, and information that the students needed to know to perform the psychomotor skill effectively. First students were provided an introduction to the Sager Traction Splint, its uses and key information about the equipment itself. Details were provided on the indications and contraindications for the use of the Sager Traction Splint and when and where the use of the splint fits

into the student's existing patient assessment and treatment model. An audio/video clip of a contextual demonstration followed, demonstrating how the Sager Traction Splint is used in managing a patient, and finally a detailed demonstration of the procedures with step-by-step instructions on how to perform them was provided. Evaluation criteria was provided, as well as sections on common errors and frequently asked questions. Quizzes were embedded into the multi-media lessons to allow students to review the material and to reinforce key concepts. Limited student interaction occurred within the multi-media lesson with students dragging and dropping icons to identify various component parts and their function of the Sager Traction Splint. See Appendix E for a more detailed overview of a Sager Traction Splint lesson plan. See Appendix F for three screen-captured images taken from the multi-media CD-ROM lesson plan.

The development of the Sager Traction Splint multi-media lesson plan went through a formal planning process within the Instructional Design department at the Paramedic Academy. There were three main phases to the project: Alpha, Beta, and Production Master. The Alpha phase involved creating a scope document, budget estimates, writing lesson objectives and content, identifying equipment and facilities and reviewing content with subject matter experts. Filming and rough-cut editing of the multi-media footage also took place in the Alpha phase. This included hiring and training actors to play the part of the simulated patient, shooting numerous takes of each demonstration from various camera angles, isolating particular components within the demonstration with digital stills and close-ups, and reviewing footage to ensure the demonstrations were depicted perfectly. The Beta phase involved more

editing and mixing of audio and video as well as field-testing of the product.

Modifications and revisions were made in this phase as well. The Production Master phase involved last minute editing, debugging, and review before production of the final product. See Appendix G for an example of a portion of the multi-media screen content template that was used in the Alpha phase.

CRITERION-REFERENCED EVALUATIONS. Criterion-referenced checklists were used to evaluate student performance (Appendix B). These checklists itemized and sequenced the 15 psychomotor skills needed to properly apply a Sager Traction Splint as well as objectively guided the evaluators in providing fair and consistent marking. The validity of the criterion-referenced checklists was based on:

- The Sager Traction Splint manufacture's suggested method of application.
- The review of 15 subject matter experts (Paramedic Academy Regional Training Coordinators).
- All treatments and protocols taught to paramedics within British Columbia are reviewed and approved by the British Columbia Ambulance Service's medical advisory committee. This committee is comprised of emergency physicians and a representative from the paramedic licensing authority.

Each of the 15 criteria items on the checklist had to be marked by the evaluators as either acceptable or unacceptable. No partial marks were given. The rationale for that was that the student's employer, and the general public for that matter, did not want students learning invasive medical procedures only to a percentile of proficiency.

Students were asked to apply the Sager Traction Splint onto a colleague's leg however the simulation was set in context to a real ambulance call. For example, the student was told: "The patient (fellow student) was found sitting, you have completed all your Primary Survey and Secondary Survey patient assessments, entonox has been applied for pain, ice has been on the fracture for approximately five minutes, and all circulation, sensation, and function checks were done in your patient assessment and were found to be normal." There were four possible patient scenarios that were supplied to each Regional Training Coordinator and, these in turn, were randomly assigned to students prior to them beginning their student performance. Regardless of the "patient" scenario used, the psychomotor steps required for the proper application of the Sager Traction Splint remained the same. See Appendix H for details on the scenario possibilities that were available to the Regional Training Coordinators.

Initially every student's performance in the sample was viewed and assessed by two different evaluators. As mentioned these evaluators were not informed as to which instructional methodology that the students had been exposed. If there was consensus on all 15 of the checklist criteria items then there was no further evaluation. If however, there was not consensus a third evaluator assessed that particular student. A two-thirds majority then determined if the student was acceptable or unacceptable on any particular checklist criteria item.

STUDENT PERFORMANCE GUIDELINES. The three evaluators were given Student Performance Guidelines to assist them in making fair and objective decisions regarding the student's performance. These guidelines provided

parameters for each checklist criteria item that each evaluator could use as a reference in determining the acceptability of student performance. These guidelines also standardized the documentation of the evaluation. For example, one of the psychomotor skills that the students needed to perform was to check distal circulation, sensation, and function in the injured leg after the Sager Traction Splint had been applied. The guidelines state that to be acceptable the student must check all three criteria to be acceptable and then goes on to provide details and options on what would be an acceptable distal circulation check, sensation check and functional check. See Appendix C for complete details of the Student Performance Guidelines.

VIDEO RECORDING EQUIPMENT. Each regional workshop was supplied VHS camcorders and videotapes. The Regional Training Coordinators were briefed on the operation, use, and expectations of the videotaping of the student evaluations. This equipment was ordered and distributed via the Paramedic Academy Stores Department at the Justice Institute of British Columbia. Specific instructions were provided to the Regional Training Coordinators regarding the experimental procedure, labeling, tracking, and shipping of evaluation materials (Appendix D). Videotaping student performance for later evaluation had its limitations. Camera angle, camera focus, and audio hindered accurate assessment. One student performance had to be negated because of no audio. Out of 1545 criteria items assessed on videotape, 53 criteria items or 3% had to be marked as “not observed” because of poor camera angle or the student blocking the view of the camera. Problems with videotaping the evaluations were identified in the Pilot Study (Appendix J) and some modifications were made, however, more time could have

been spent on training in the use of the video cameras. The other possibility was to hire a camera operator.

FOLLOW-UP QUESTIONNAIRE. An electronic follow-up questionnaire was sent to all participants in the treatment group. They were asked how much time they had spent working through the multi-media lesson plan, about any technical problems they may have encountered, their preference to distance learning versus face-to-face learning, the effect of being videotaped while being assessed, and their confidence in applying the Sager Traction Splint (Appendix I).

### PILOT STUDY

A pilot study occurred two months before the actual experiment, allowing time to work out any logistical or procedural bugs in the experimental process. The pilot study followed very closely the same format of the actual experiment except that the participants were not divided into control and treatment groups. One group of six subjects participated in the Sager Traction Splint multi-media lesson plan with no interaction or instruction in a face-to-face setting. The selection of the students and the location of the pilot study were not chosen randomly. The pilot study location was chosen for convenience and time frame considerations. The sample of students were still new recruits entering into British Columbia Ambulance Service, the instrumentation materials for the experiment remained unchanged, and the data collection procedures remained the same.

Conducting the pilot survey early allowed time for modifications in the experimental process. Specifically, the controls of the experiment were examined to ensure that a fair, objective, and unbiased process was in place. Feedback was



obtained from the evaluators on the effectiveness and ease of use of the criterion-referenced checklist and the usefulness of the student performance guidelines. The Regional Training Coordinator provided input on the logistics of videotaping each student performance as well as the logistical considerations of tracking each participant. Videotapes were viewed to ensure that fair objective assessment could in fact occur by watching the student's performance on video. And finally, all logistical considerations were reviewed and modified as required. See Appendix J for details that were modified because of the feedback obtained in the pilot study.

### DATA COLLECTION

The researcher was responsible for tracking, labeling, and shipping all evaluation materials, detailed instructions, and the videotapes to the Regional Training Coordinators. The researcher also coordinated the ordering and shipping of the video cameras into each region. The Regional Training Coordinators were then responsible for conducting the assessments, labeling, and shipping the videotapes back to the researcher. From there the researcher re-labeled and catalogued each videotape removing all reference to the student's name or the student's location. Cataloguing consisted of assigning an alphanumeric code matching a videotape to each member of the sample. All videotapes were then randomly divided into two piles and each pile was then shipped to one of two evaluators. Each evaluator was instructed to view and assess each videotape and then forward their box of videotapes on to the other evaluator. Hence each videotape was assessed twice by two different evaluators with each evaluator unaware of which instructional methodology was used to teach the student. All criterion-referenced checklists were

sent directly back to the researcher. Once each videotape was viewed and assessed twice, evaluators were instructed to send the videotapes back to the researcher. The researcher established a file matching the alphanumeric code of the videotapes with each of the two checklists per student.

The data that were collected was the videotape of each subject's performance of applying the Sager Traction Splint. From that, primary data were obtained by having evaluators assess each student's performance and recording the results on a criteria-referenced checklist. Initially every student's performance in the sample was viewed and assessed by two different evaluators. These results were entered into the researcher's laptop computer in a spreadsheet. If there was consensus on all 15 of the checklist criteria items then there was no further evaluation. If however, there was not consensus, that particular videotape was sent to a third evaluator for assessment and then the videotape returned to the researcher. The data were entered into the laptop and a two-thirds majority then determined if the student was acceptable or unacceptable on any particular checklist criteria item. The primary data that were extracted was the student's performance achievement on the application (psychomotor skill) of the Sager Traction Splint.

Communication follow-up via email and telephone was required to remind the Regional Training Coordinators and the evaluators of the logistical flow of materials and to ensure compliance in sending the required data.

### TREATMENT OF DATA

The sample size was 42 paramedical students from various parts of British Columbia. Each student's performance on applying the Sager Traction Splint was

evaluated twice with 22 students performances being assessed a third time for a total of 106 assessments. All these assessments were captured on individual criterion-referenced checklists. Each checklist contained 15 psychomotor skills or steps that comprise the successful application of the Sager Traction Splint. Each of these 15 psychomotor skills was evaluated as either being acceptable or unacceptable for each of the 106 assessments. The data were entered into a spreadsheet on the researcher's personal computer. The spreadsheet depicted individual student achievement (all personal names were changed to an alphanumeric code) for each of the 15 psychomotor skills from each evaluator.

All the items on the criteria-referenced checklists were to be expressed as categorical values (acceptable or unacceptable), therefore, a nonparametric statistical analysis was used to explain the results, specifically the Mann-Whitney Test.

As described earlier, students had one of four possible patient scenarios that they were required to apply the Sager Traction Splint in. Scenario one involved a sitting patient with a closed tibia/fibula fracture. Scenario two involved a closed mid-shaft femur fracture with the patient supine. The third scenario had a patient with a femur fracture but it was near the knee joint. The final scenario was an open mid-shaft tibia/fibula fracture. Not all scenarios were utilized equally within the sample therefore the nonparametric Kruskal-Wallis Test was used to statistically analyze any discrepancies in student performance between patient scenarios.

## SUMMARY

The research methodology was an experimental, post-test only, group comparison of two different instructional methodologies. New recruits of the British Columbia Ambulance Service who, upon entering paramedical training, were assigned to either a control or treatment experimental group. The decision on whether or not a group was in a control or treatment group was done on a random basis. Subjects of the experiment were taught a core paramedical psychomotor skill, the application of the Sager Traction Splint, by one of two instructional methodologies. The control groups were taught using a traditional face-to-face demonstrate, describe, and practice instructional methodology where the treatment group was taught solely with multi-media enhanced distance education. Each student's performance on the application of the Sager Traction Splint was evaluated minimally twice and sometimes three times using criterion-referenced checklists. All student performances were videotaped. Instrumentation for the conduction of the experiment involved a variety of tools: the multi-media CD-ROM instructional technology, the Internet, criterion-referenced checklists for the Sager Traction Splint, student performance guidelines to assist evaluators in inter-rater reliability, video cameras to capture the student's performance of the psychomotor skill in applying the Sager Traction Splint to a simulated patient, and follow up questionnaires. A pilot study occurred two months before the actual experiment, allowing time to work out any logistical or procedural bugs in the experimental process. The experiment took approximately six months to complete. Data were collected, confidentially categorized into control and treatment files and then three specially trained

evaluators, who were unaware of the instructional methodologies used to instruct the students, evaluated the student's performance. This ensured fair, objective and unbiased results. Following the collection of data, the results were statistically analyzed using the Mann-Whitney Test and the Kruskal-Wallis Test.

## CHAPTER IV

### RESULTS

#### REVIEW OF THE STATEMENT OF PURPOSE

The purpose of this study was to compare the efficacy of two different instructional methodologies in teaching a core paramedical psychomotor skill. One methodology was the traditional face-to-face instruction of a live demonstration, a description of the procedure, followed by coached practice and feedback. The other instructional methodology was a multi-media enhanced distance education lesson plan where students would learn the same psychomotor skill with no direct contact with an instructor. The psychomotor skill that was examined was the application of pre-hospital fracture management device, the Sager Traction Splint.

#### ANALYSIS

A Mann-Whitney U test was conducted to evaluate the null hypothesis that there was no difference in the effect of the two instructional methods (multi-media, face-to-face) on the unacceptable scores for all 15 criteria that comprised the Sager Traction Splint procedure. The results of the test were not significant,  $z = -.909$ ,  $p = .389$ . The multi-media instructional method resulted in a mean of 14.1 unacceptable scores while the face-to-face instructional method resulted in a mean of 16.9 unacceptable scores. Therefore, the conclusion was that there was no significant difference in the effectiveness of multi-media enhanced distance education and conventional instruction of a core paramedical skill.

Table 3. Mann-Whitney Test

	Ranks			
	Method	N	Mean Rank	Sum of Ranks
Unacceptable	Multi-media	15	14.10	211.50
	Face-to-face	15	16.90	253.50
	Total	30		

Test Statistics (b)

	Unacceptable
Mann-Whitney U	91.500
Wilcoxon W	211.500
Z	-.909
Asymp.Sig. (2-tailed)	.363
Exact Sig. [2*(1-tailed Sig.)]	.389(a)
A Not corrected for ties	
B Grouping Variable: method	

The 15 psychomotor competencies that were assessed were as follows:

1. Explains all actions and procedures to the patient.
2. Ensures ice is applied to the fracture site for ten minutes and then takes ice off for five minutes before re-applying.
3. Ensures the patient is positioned supine for the application of the splint.
4. Ensures the Sager Traction Splint is appropriately sized to the patient.
5. Places splint on medial aspect of the leg.
6. Slides thigh strap under leg without excessive movement or aggravation of the injury.
7. Instructs patient to inform of any discomfort while sliding the splint into the groin area.

8. Secures thigh belt snugly without excessive movement or aggravation of the injury.
9. Applies ankle harness to the injured leg above the malleoli and ensures a snug fit without excessive movement or aggravation of the injury.
10. Ensures splint is adequately padded.
11. Applies the appropriate amount of traction.
12. Ensures ankle strap does not slip down over malleoli.
13. Applies three elasticized straps from stable to unstable.
14. Rechecks distal circulation, sensation, and function after splinting.
15. Pads between patient's legs and secures both limbs with triangular bandages or elasticized straps.

Evaluators categorized, on a criterion-referenced checklist, the student's performance as either "acceptable" or "unacceptable". The results of all the assessments were tabulated on a spreadsheet and entered onto the researcher laptop computer. See Table 4 for a portion of the data that were captured.



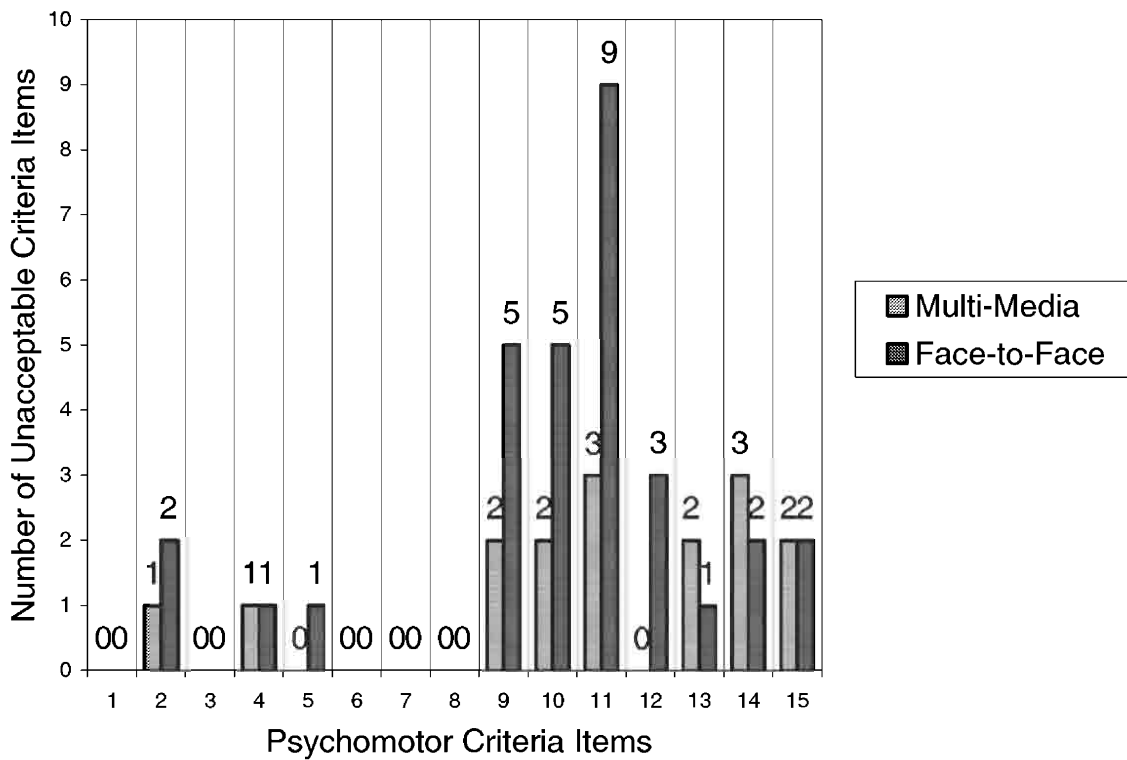
Table 4. Example of a portion of the spreadsheet containing primary data

Checklist Criteria Items															
Catalogue Code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
02MMCR01															
Evaluator One	A	A	A	A	A	A	A	A	A	A	A	A	A	U	A
Evaluator Two	A	A	A	A	A	A	A	A	A	A	A	A	A	U	A
Evaluator Three															
04MMCR02															
Evaluator One	A	A	A	A	A	A	A	A	A	A	U	A	A	A	A
Evaluator Two	A	A	A	A	A	A	A	A	A	A	U	A	A	A	A
Evaluator Three															
01MMCR03															
Evaluator One	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Evaluator Two	A	A	A	A	A	A	A	A	U	A	A	A	A	A	A
Evaluator Three	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
03MMCR04															
Evaluator One	A	A	A	A	A	A	A	A	A	A	A	A	U	A	A
Evaluator Two	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Evaluator Three	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
03MMCR05															
Evaluator One	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Evaluator Two	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Evaluator Three															

Note. Checklist Criteria Items 1-15 refers to the fifteen psychomotor procedures students were expected to perform while applying the Sager Traction Splint. The first two digits in the alphanumeric Catalogue Code depict the patient scenario that was used for that particular student, the first two letters depict whether the student was taught via Multi-Media (MM) or Face-to-Face (FF), the third and fourth letters are abbreviations of the various communities where the assessments took place (For example, CR is Cranbrook), the last two digits represent individual students. “A” and “U” represent Acceptable and Unacceptable student performance, respectively.

Figure 1 depicts a bar chart comparison of all 15 criteria-items for both the treatment and control groups. Notice that in only two out of fifteen criteria items (criteria items 13 and 14) did the control group have fewer unacceptable scores than the treatment group.

Figure 1. Total Sample Comparison

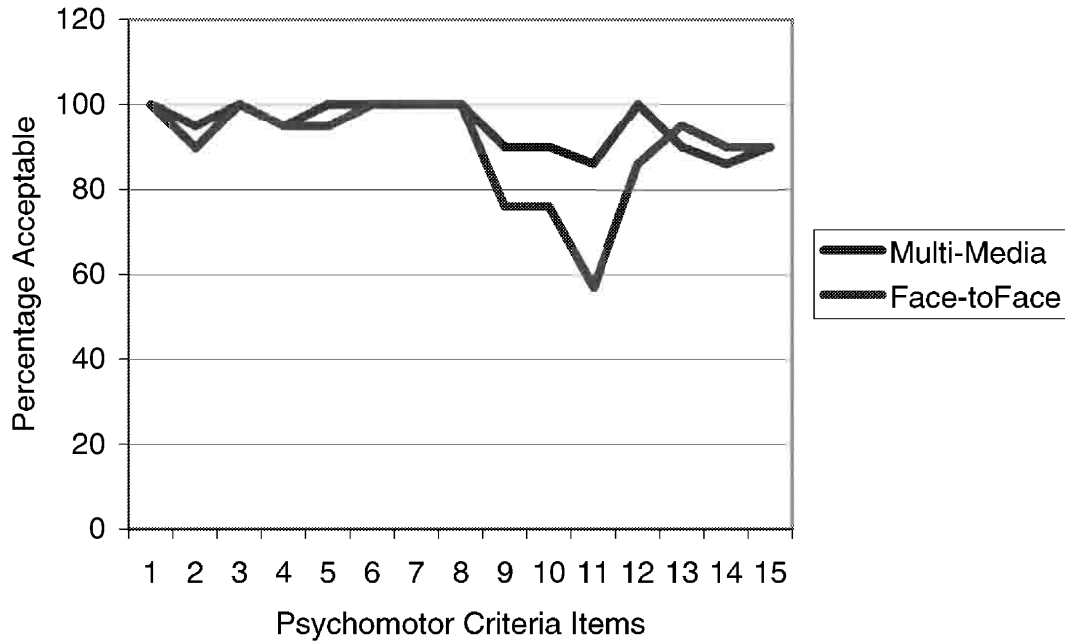


For criteria items one, three, six, seven, and eight, 100% of the students from both groups performed these psychomotor skills acceptably. In reviewing Simpson’s (1972) break down of psychomotor skills these five criteria items were less complex than others in applying the Sager Traction Splint. Criteria items one and seven dealt with what Simpson called “set”, or the readiness to take a particular course of action. Criteria items three, six and eight would fall within Simpson’s category of

“mechanism”, where learned responses become habitual. In examining the criteria, items nine and eleven were found to be more complex and required highly coordinated psychomotor movement, falling into Simpson’s “complex overt responses” category. Both these psychomotor steps required fine motor coordination, dexterity, and complex movement. Note that in Figure 1, students within the treatment group performed appreciably better than their counterparts in the control group in these two criteria items. Item 10 had a combined total of seven unacceptable scores and yet this was a relatively simple psychomotor skill of padding the Sager Traction Splint. One possible explanation for this was that newer models of the Sager Traction Splint came pre-padded, and in some paramedic training regions within British Columbia paramedics may not have had access to the latest model of the splint. Figure 2 shows the same sample comparison but this time depicting the percentage of acceptable criteria. Figure 2 clearly illustrates a pattern of student performance with both instructional methodologies, a pattern that shows similar strengths and weaknesses for individual criteria items.

Two meaningful trends emerged when examining Figure 1 and Figure 2. Firstly, the treatment group consistently performed as well as or better than the control group on 87% of the psychomotor steps required to apply the Sager Traction Splint. Secondly, in two out of three of the complex psychomotor skills, the treatment group outperformed in comparison to the control group.

Figure 2. Percentage comparison of total sample performance between Multi-Media and Face-to-Face



A Kruskal-Wallis Test was conducted to evaluate the null hypothesis that there was no difference in the effect of different patient scenarios on the number of unacceptable scores. The results indicate that there was a significant difference for patient scenario one,  $X(1, N=30), 5.733, p=.017$ , but not for the other three patient scenarios. See Table 5. Examination of the uniqueness of patient scenario failed to explain the results of the Kruskal-Wallis Test. See below. Further conclusions were drawn in Chapter Five as to why student performance was significantly better in the treatment group for patient scenario one.

Table 5. Kruskal-Wallis Test

	Ranks		
	Method	N	Mean Rank
Scenario 1	Multi-media	15	12.30
	Face-to-face	15	18.70
	Total	30	
Scenario 2	Multi-media	15	15.30
	Face-to-face	15	15.70
	Total	30	
Scenario 3	Multi-media	15	16.33
	Face-to-face	15	14.67
	Total	30	
Scenario 4	Multi-media	15	14.40
	Face-to-face	15	16.60
	Total	30	

Test Statistics (a, b)				
	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Chi-Square	5.733	.022	.453	.789
Df	1	1	1	1
Asymp. Sig.	.017	.881	.501	.374
A Kruskal Wallis Test				
B Group Variable: method				

A total of four different patient scenarios were used when assessing student performance in applying the Sager Traction Splint:

1. Closed mid-shaft tibia/fibula fracture. Patient is sitting.
2. Closed mid-shaft femur fracture. Patient is supine.
3. Closed distal femur fracture. Patient is supine.
4. Open mid-shaft tibia/fibula fracture. Patient is supine.

Figure 3 depicts a comparison of the total number of unacceptable scores for all 15 psychomotor criteria items in patient scenario one. As described in the Kruskal-Wallis Test, the treatment group performed significantly better than the control group in this particular patient scenario. One unique attribute of patient scenario one was

that the patient was presented sitting. That being said, criteria item three evaluated whether or not the student laid the patient supine before applying the Sager Traction Splint, and Figure 3 depicts that 100% of students from both the multi-media and the face-to-face groups performed that skill correctly. Once the patient is supine, all the criteria items were very similar to all the other patient scenarios. In comparing Figure 3 with Figure 1 the overall pattern of student performance is very similar.

Figure 3. Patient Scenario Number One

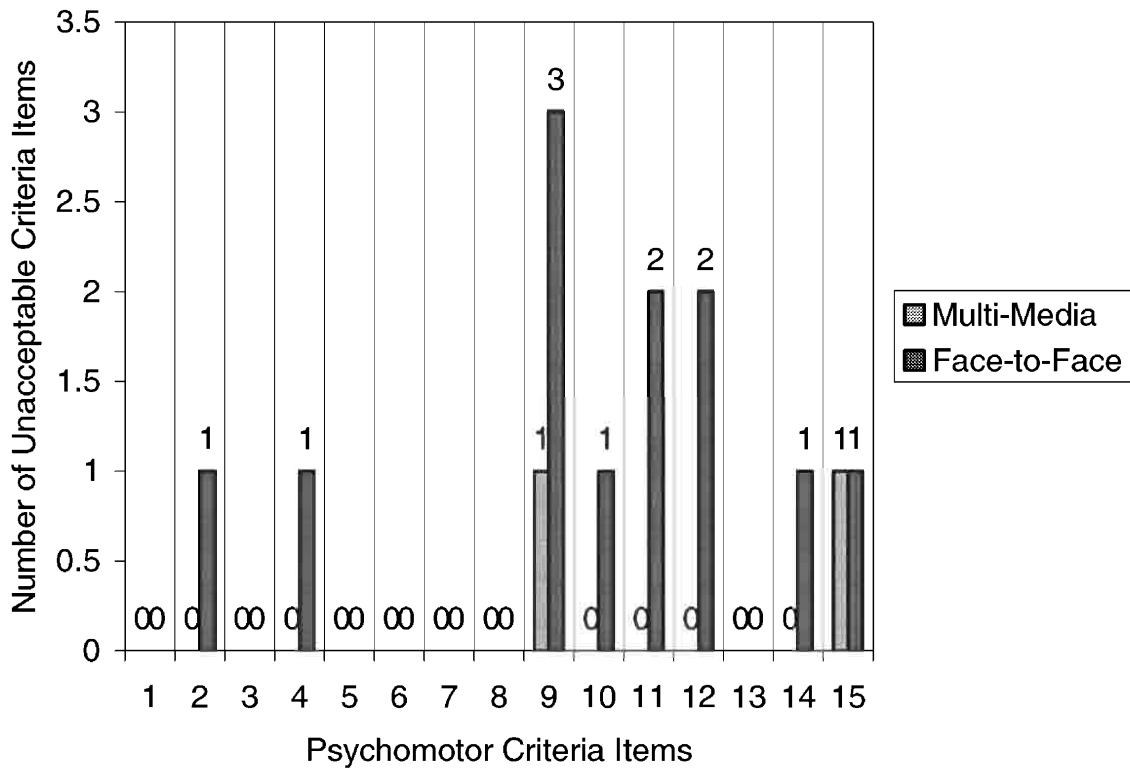


Figure 4, Figure 5, and Figure 6 depict the remaining patient scenarios and the pattern that evolved further suggests that variations in the patient presentation had no effect on student performance regardless of instructional methodology.

Figure 4. Patient Scenario Number Two

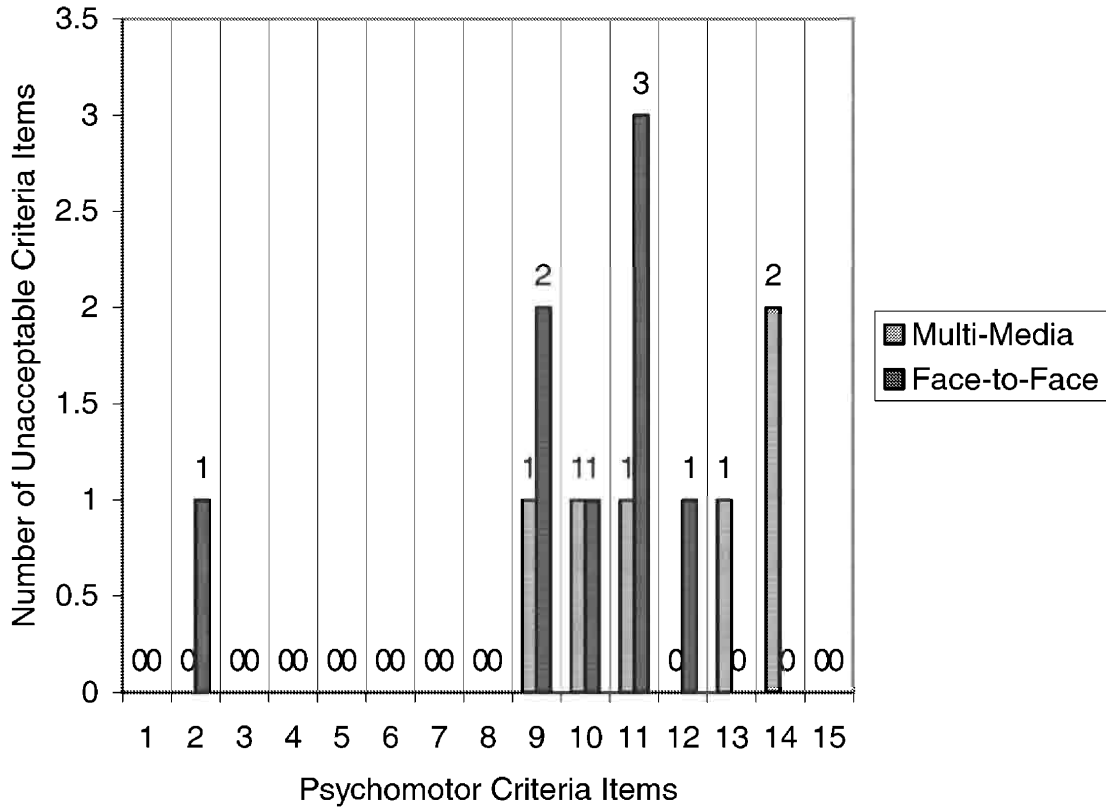


Figure 5. Patient Scenario Number Three

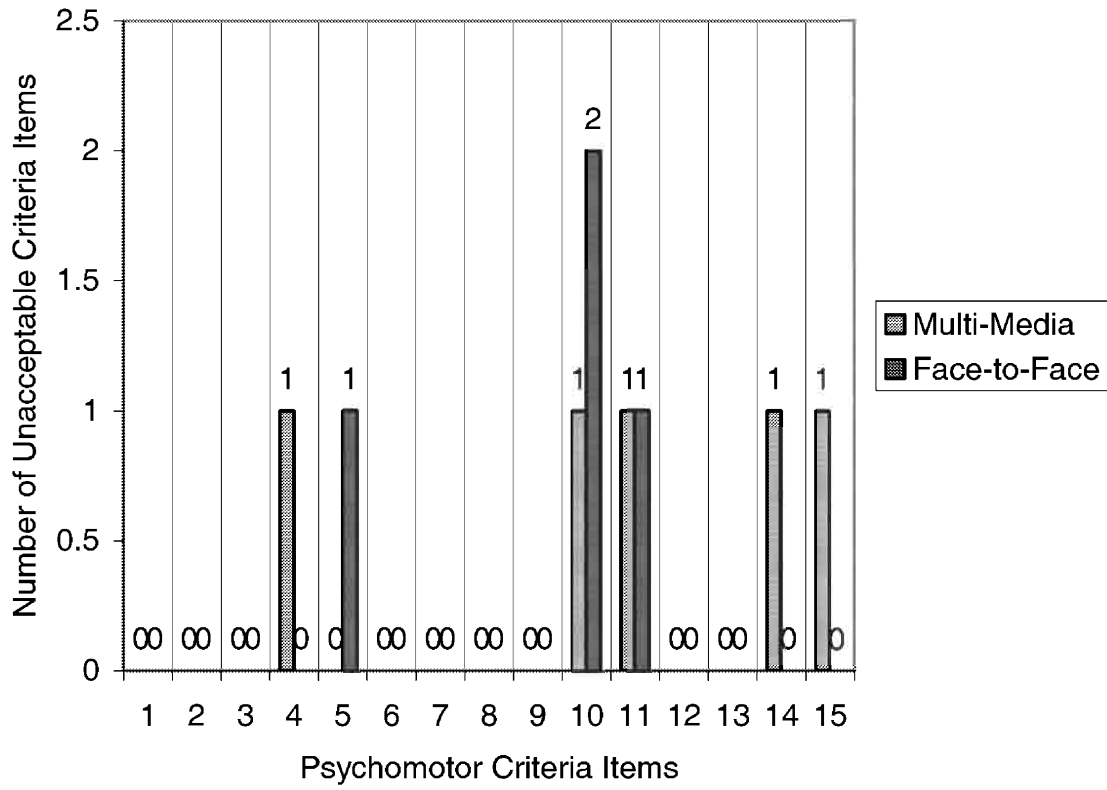
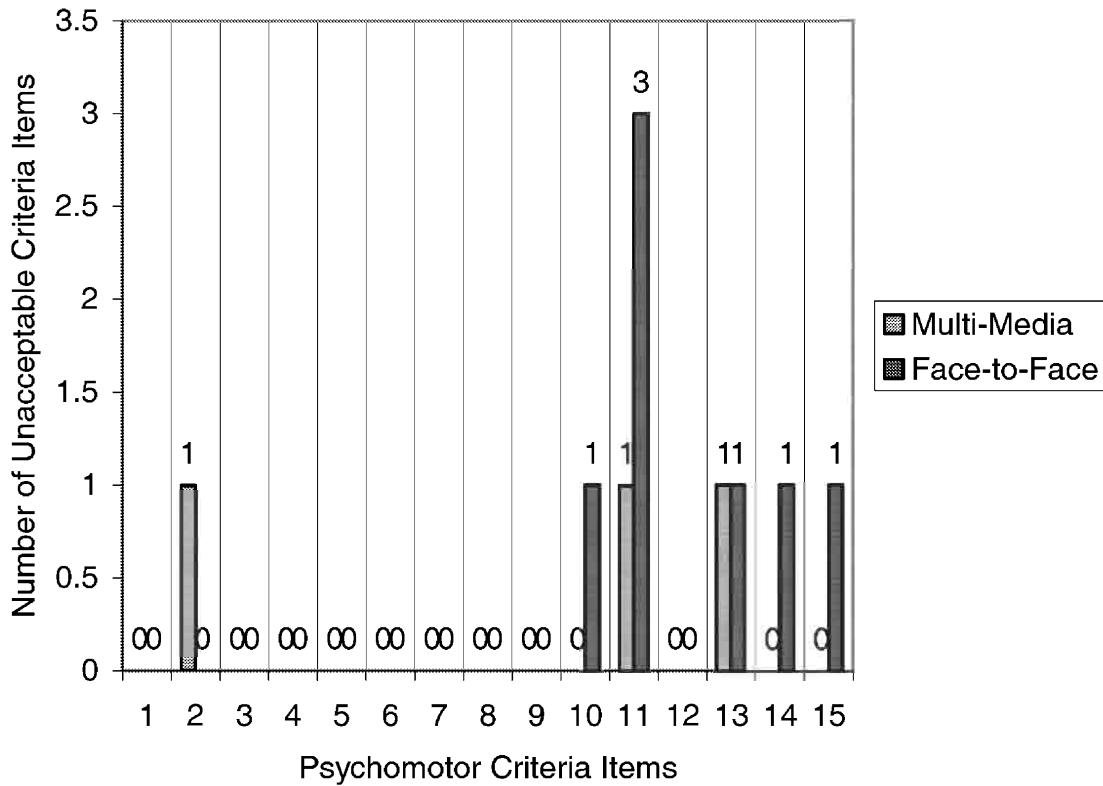




Figure 6. Patient Scenario Number Four



### FOLLOW-UP QUESTIONNAIRE RESULTS

A total of 21 follow-up questionnaires were emailed to all the participants in the treatment group. No questionnaires were sent to the control group as the information polled on the questionnaire pertained directly to the multi-media distance education lesson plan. Fourteen questionnaires or 66% were returned. A summary of the results is presented below:

QUESTION ONE. Approximately how much time did you put in to prepare for your Sager Traction Splint evaluation? This would include time spent completing the multi-media CD-ROM and any hands on practice. Table 6 depicts the results.

Table 6. Time spent preparing for the Sager Traction Splint evaluation

Participant	1	2	3	4	5	6	7	8	9	10	11	12	13	14
0.5—1.0 hours	X													
1.0—2.0 hours		X	X	X	X	X		X		X	X	X	X	X
2.0—3.0 hours									X					
> 3.0 hours							X							

QUESTION TWO. Did you experience any technical problems that interfered with you completing the Sager Traction Splint multi-media lesson plan? If yes, briefly describe the technical problems and how they were overcome. Seventy-one percent of the respondents reported no technical problems with 21% reporting minor technical problems. These included:

- Difficulty finding instructions on how to access the multi-media lesson plan. This was resolved by asking a fellow student.
- Initially could not get the audio/video components on the CD-ROM to function properly. No explanation was given on how this was resolved.
- Initially could not get CD-ROM to function. Resolved by calling the Paramedic Academy's Callcentre.
- Computer "froze" when CD-ROM was being accessed. Resolved by re-booting the computer.

QUESTION THREE. I prefer learning with the multi-media lesson plans to the traditional face-to-face instructional method? A Likert scale was used to record student's opinions. See Table 7.

Table 7. Preference of multi-media distance education to face-to-face

Participant	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Strongly Agree														
Agree		X			X		X							
No Difference	X								X		X			
Disagree			X	X		X		X		X		X		
Strongly Disagree													X	X

Only 21% preferred the multi-media distance education compared to face-to-face instruction. Twenty-one percent found there was no difference, but 57% stated that they preferred face-to-face instruction to the multi-media distance education lesson plan.

QUESTION FOUR. Being videotaped during my assessment affected my performance. A Likert scale was used to record student’s opinions. See Table 8.

Table 8. Affects of being videotaped on performance

Participant	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Strongly Agree														
Agree		X	X								X		X	
No Difference				X		X			X			X		
Disagree	X				X			X						
Strongly Disagree							X			X				X

Twenty-nine percent of the participants did feel that being videotaped affected their performance whereas the remaining 71% felt being videotaped had no affect on their performance.

QUESTION FIVE. I feel confident in my knowledge and skill in applying the Sager Traction Splint. A Likert scale was used to record student’s opinions. See Table 9.

Table 9. Confidence in knowledge and skill in applying the Sager Traction Splint

Participant	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Strongly Agree	X	X	X		X	X								X
Agree				X			X	X		X		X	X	
No Difference											X			
Disagree									X					
Strongly Disagree														

Eighty-six percent of the participants felt confident in their ability to apply the Sager Traction Splint. One participant was neutral and only one participant expressed concerns over his or her ability to apply the splint

### SUMMARY

Results of statistical analysis showed no significant difference in the effectiveness of face-to-face instruction versus multi-media enhanced distance education in teaching a paramedical psychomotor skill.

In examining student performance on four different patient scenarios, again comparing the effectiveness of the two instructional methodologies, statistical analysis did show a significant difference on one of the four patient scenarios.

## CHAPTER V

### CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

#### CONCLUSIONS

Paramedics require a wide variety of core psychomotor skills to be able to perform their job effectively. Traditionally these skill sets have been taught in the classroom with an instructor providing a demonstration followed by coached practice and instructor feedback. The purpose of this study was to examine whether or not a paramedical psychomotor skill taught solely via distance could be as effective as traditional face-to-face instruction. The application of a pre-hospital fracture management device (Sager Traction Splint) was the psychomotor skill that was assessed. Forty-two new recruits entering into the British Columbia Ambulance Service, who were geographically dispersed around the province of British Columbia, comprised the sample for the experiment. The lesson plans for each instructional methodology were very similar in nature:

1. The Sager Traction Splint was described. The different models of the splint were discussed and shown, the various parts and functions of the splint were discussed, and storage and cleaning of the splint were described.
2. Patient management and the Sager Traction Splint. Indications and contraindications for the use of the splint were reviewed, as well as where the application of the splint would fall within general patient assessment and treatment.
3. Depiction of the application of the Sager Traction Splint. A contextual demonstration on how the Sager Traction Splint would be used on a real

patient followed by a procedural demonstration showing the isolated skills to apply the splint.

4. A chance to practice with the actual equipment reviewing common errors and frequently asked questions.

Because the multi-media and the face-to-face lesson plans were similar in nature this allowed for a more accurate assessment of the efficacy of the instructional methodologies.

Statistical results showed no significant difference in student performance between the two instructional methods however the multi-media group of students did perform consistently better on the majority of individual criteria items required to apply the Sager Traction Splint. In reviewing individual criteria items some conclusions can be drawn:

EXPLAINS ALL ACTIONS AND PROCEDURE TO THE PATIENT. The total sample (treatment and control) performed this criteria item acceptably 100% of the time. Simpson's (1972) taxonomy of psychomotor skills would describe this criterion as a readiness or preparatory adjustment for a course of action. This skill was not unique to the Sager Traction Splint. One of the requisites for entry into the British Columbia Ambulance Service is a basic first-aid course where students are typically taught to interact with their patient, to explain any procedures, actions, or treatments. Ethically and legally paramedics must obtain permission from the patient prior to any treatments or protocols.

ENSURES ICE IS APPLIED TO THE FRACTURE SITE FOR TEN MINUTES AND THEN TAKES THE ICE OFF FOR FIVE MINUTES BEFORE RE-APPLYING.

The total sample (treatment and control) performed this criteria item acceptably 93% of the time. Two students from the control group and one from the treatment group were marked unacceptable. Simpson (1972) would define this criterion as a “guided response” or “mechanism” whereby the student reproduces an action based on a defined set of rules. As the actions become more mechanical they become more habitual. Students were able to apply the ice but they were marked unacceptable because of their inability to follow the established guidelines. Applying ice in fracture management would also be a skill that would have been taught in any requisite first-aid course.

ENSURES THE PATIENT IS POSITIONED SUPINE FOR THE APPLICATION OF THE SPLINT. The total sample (treatment and control) performed this criteria item acceptably 100% of the time. Simpson’s (1972) taxonomy of psychomotor skills would describe this criterion as a readiness or preparatory adjustment for a course of action.

ENSURES THE SAGER TRACTION SPLINT IS APPROPRIATELY SIZED TO THE PATIENT. The total sample (treatment and control) performed this criteria item acceptably 95% of the time. One student from each group was marked unacceptable on this criterion. This is a relatively simple procedure of assembling and measuring the Sager Traction Splint. This was the first criteria item that truly reflected a newly learned skill. Students would have had to be competent in the knowledge and functions of many of the mechanical components of the splint. They needed to know what the splint looked like, how to assemble it, which end goes where, which side goes up, and how to lengthen it.

PLACES THE SPLINT ON THE MEDIAL ASPECT OF THE LEG. The total sample (treatment and control) performed this criteria item acceptably 98% of the time. Only one student from the control group got this criteria item marked unacceptable. Simpson's (1972) taxonomy of psychomotor skills would describe this criterion as a readiness or preparatory adjustment for a course of action but it also requires the student to follow a defined set of rules regarding the application of the Sager Traction Splint.

SLIDES THIGH STRAP UNDER LEG WITHOUT EXCESSIVE MOVEMENT OR AGGRAVATION OF THE INJURY. The total sample (treatment and control) performed this criteria item acceptably 100% of the time. This is a psychomotor skill that must be performed with proficiency to avoid aggravating the patient's injury. It is a relatively simple mechanical skill. Students would have been exposed to a similar procedure in requisite first-aid courses.

INSTRUCTS PATIENT TO INFORM OF ANY DISCOMFORT WHILE SLIDING THE SPLINT INTO THE GROIN AREA. The total sample (treatment and control) performed this criteria item acceptably 100% of the time. Simpson's (1972) taxonomy of psychomotor skills would describe this criterion as a readiness or preparatory adjustment for a course of action. This is not unique to the Sager Traction Splint. In the requisite basic first-aid course, students are taught to interact with their patient, to explain any procedures, actions, or treatments. Ethically and legally, paramedics must obtain permission from the patient prior to any treatments or protocols.



SECURES THE THIGH BELT SNUGGLY WITHOUT EXCESSIVE MOVEMENT OR AGGRAVATION OF THE INJURY. The total sample (treatment and control) performed this criteria item acceptably 100% of the time. This is a psychomotor skill that must be performed with proficiency to avoid aggravating the patient's injury. It is a relatively simple mechanical skill. Students would have been exposed to a similar procedure in requisite first-aid courses.

APPLIES ANKLE HARNESS TO THE INJURED LEG ABOVE THE MALLEOLI AND ENSURES A SNUG FIT WITHOUT EXCESSIVE MOVEMENT OR AGGRAVATION OF THE INJURY. The total sample (treatment and control) performed this criteria item acceptably 83% of the time. Five students from the control group and two from the treatment group were marked unacceptable. There were four conclusions to be drawn from these results. One was that the multi-media lesson depicts demonstrations perfectly. During the shooting of the multi-media lesson numerous takes could be taken until the director and subject matter expert were satisfied that the video demonstration was flawless. Secondly, was that when students were watching the demonstration in the multi-media lesson, that particular skill was isolated. In other words, for this particular criteria item of applying the ankle harness to the patient's leg, the student only observed that activity. They were not distracted by extraneous stimuli. Thirdly, the multi-media lesson had the advantage of showing different angles of the skill being performed. In a live demonstration, it was difficult for the instructors to position themselves so that all students could clearly see this complex psychomotor skill being performed. The multi-media lesson also had the advantage of instant replay. Lastly, the multi-media lesson consistently

isolated common errors and provided tips for avoiding these errors whereas in a live demonstration this may or may not have occurred.

ENSURES SPLINT IS ADEQUATELY PADDED. The total sample (treatment and control) performed this criteria item acceptably 83% of the time. Five students from the control group and two from the treatment group were marked unacceptable. This is not a complex psychomotor skill and it would be a standard treatment for fracture management in any requisite first-aid course students would have taken. The conclusions cited for the previous criterion would also apply here for why the treatment group performed more favorably than the control group, but it does not address why this criteria item was tied for second on being the most difficult for students to perform acceptably.

APPLIES THE APPROPRIATE AMOUNT OF TRACTION. The total sample (treatment and control) performed this criteria item acceptably 71% of the time. Nine students from the control group and three from the treatment group were marked unacceptable. Simpson's (1972) taxonomy of psychomotor skills would describe this criterion as a complex overt response with a requirement of adaptation. To apply the actual traction on the Sager Traction Splint requires fine motor control and coordination. This skill was adaptive in that students would have to decide, based on the patient's presentation, what amount of traction would be appropriate for that particular patient. Students must modify and possibly re-apply or adjust traction to meet the needs of the patient. One can conclude that the more complex the psychomotor skill was, the more difficult it was for students to master. This criteria item produced the greatest discrepancy in student performance between the

treatment group and the control group. For the treatment group 18 out of 21 students evaluated performed this skill acceptably, or a score of 85%. For the control group 12 out of 21 students evaluated performed this skill acceptably, or a score of 57%. There are five conclusions to be drawn from these results. One was that the multi-media lesson depicted demonstrations perfectly. During the shooting of the multi-media lesson, numerous takes could be taken until the director and subject matter expert were satisfied that the video demonstration was flawless. Secondly, when students were watching the demonstration in the multi-media lesson, that particular skill was isolated. In other words, for this particular instructional step of applying the appropriate amount of traction on the Sager Traction Splint, the student only observed that activity. They were not distracted by extraneous stimuli. Thirdly, the multi-media lesson has the advantage of showing different angles and zooming in on the traction wheel as the skill is being performed. In a live demonstration, it was difficult for the instructors to position themselves so that all students could clearly see this complex psychomotor skill being performed and students would certainly not be able to clearly see the amount of traction being applied. The multi-media lesson also had the advantage of instant replay. Fourthly, the multi-media lesson consistently isolated common errors and provided tips for avoiding these errors whereas in a live demonstration this may or may not have occurred. Lastly, the multi-media clearly depicted the adaptation that is required in monitoring, modifying, and altering traction to meet the standards of patient care.

ENSURES THE ANKLE STRAP DOES NOT SLIP DOWN OVER THE MALLEOLI. The total sample (treatment and control) performed this criteria item

acceptably 93% of the time. Three students from the control group and zero from the treatment group were marked unacceptable. Using Simpson's (1972) psychomotor taxonomy this criteria item would be described as "perception", or the ability to use sensory cues to guide motor activity. The student had to detect or identify whether or not the Sager Traction Splint ankle strap was positioned properly. The advantages of replay and isolated depiction of the skill could account for the superior performance by the multi-media group.

APPLIES THREE ELASTICIZED STRAPS FROM STABLE TO UNSTABLE.

The total sample (treatment and control) performed this criteria item acceptably 93% of the time. One student from the control group and two from the treatment group were marked unacceptable. This is a mechanical skill that is guided by a simple set of standards. One possibility for the superior performance of the control group was that this skill was easily shown to a large group of students. Fine detail and accuracy were not required, students simply observed the order of the straps being applied.

RECHECKS DISTAL CIRCULATION, SENSATION, AND FUNCTION AFTER SPLINTING. The total sample (treatment and control) performed this criteria item acceptably 88% of the time. Two students from the control group and three from the treatment group were marked unacceptable. Simpson (1972) would describe this skill as a complex overt response. Proficiency involved an accurate assessment of the patient's distal pulses, neurological sensation, and motor function on the injured limb. This skill was clearly depicted within the multi-media lesson so why then did the student's performance not reflect this? One conclusion is that students, in requisite first-aid courses, are taught to check distal pulses before and after splinting

a limb but not necessarily to check sensation and function, and that during the Sager Traction Splint evaluation they defaulted back to a more habitual psychomotor response of just checking for a distal pulse.

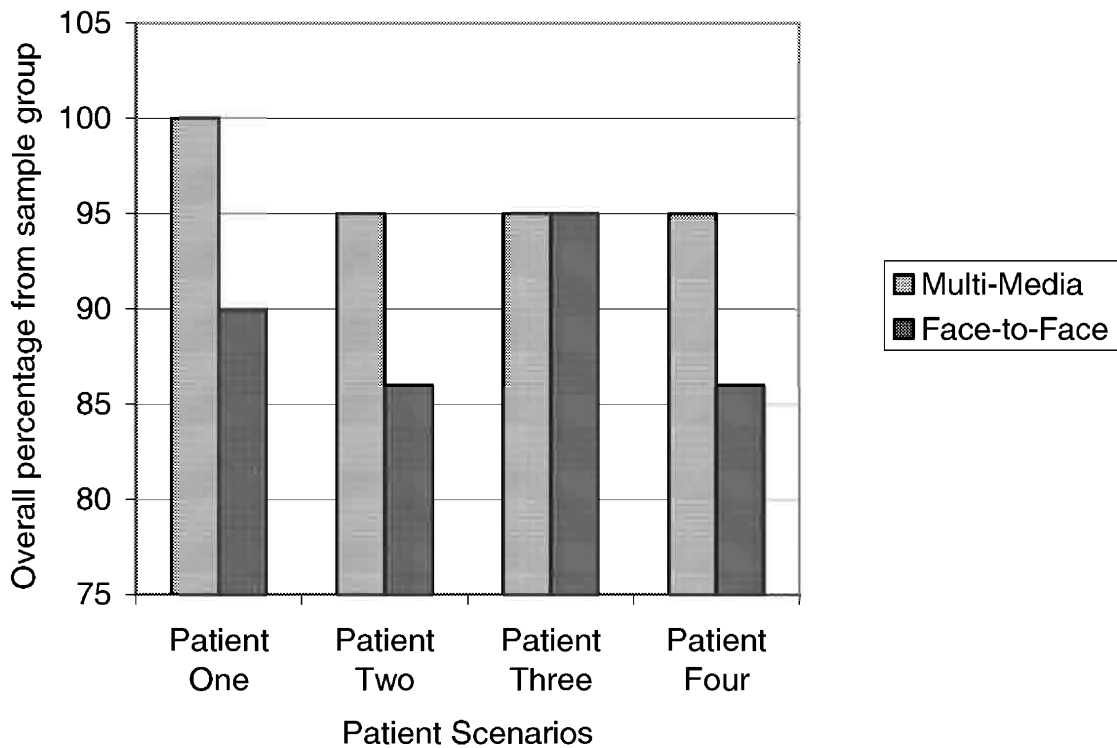
PADS BETWEEN PATIENT'S LEGS AND SECURES BOTH LIMBS WITH TRIANGULAR BANDAGES OR ELASTICIZED STRAPS. The total sample (treatment and control) performed this criteria item acceptably 90% of the time. Two students from the control group and two from the treatment group were marked unacceptable. This was a mechanical skill that was outcome based. Students had to secure both legs together but in no particular sequence.

Statistical analysis was also done to determine the efficacy of face-to-face instruction versus multi-media enhanced distance education when students were presented a variety of patient scenarios. The Kruskal-Wallis Test did show a significant difference in one of the four patient scenarios. In examining this particular patient scenario conclusions can be drawn from it.

PATIENT SCENARIO ONE. This involved a patient with a closed mid-shaft tibia/fibula fracture. The patient was presented sitting. One unique attribute of this patient scenario was the fact that the patient was found in a sitting position. One of the psychomotor criteria items in the application of the Sager Traction Splint was to ensure the patient is positioned supine before the application of the splint. In examining the student performance results, it revealed that 100% of the total sample laid the patient supine prior to splinting the leg thereby nullifying the uniqueness of this criteria item. Criteria item number 11 had the student applying traction to the patient's leg. Depending on the type of injury (open or closed) and the location of the

injury (mid-shaft or at or near a joint) would determine the proper amount of traction to apply. Patient scenarios one and two required the student to apply 4.5 kilograms (10 pounds) of traction and scenarios three and four required the student to apply 2.3 kilograms (5 pounds) of traction. Figure 7 depicts the student performance for criteria item number 11 (applying traction) for all four of the patient scenarios.

Figure 7. Criteria item # 11: Applies the appropriate amount of traction



In examining Figure 7 it is apparent that patient scenario one is not meaningfully different than the other patient scenarios. By nullifying criteria items 3 and 11, all the remaining criteria items become identical to the other patient scenarios. One can then conclude that the significant difference shown in the Kruskal-Wallis Test for

patient scenario one is not of value in determining the effectiveness of the two instructional methodologies in teaching a paramedical psychomotor skill.

### IMPLICATIONS

Emergency Medical Service (EMS) organizations, as well as many other post secondary institutions, are turning to distance education as a possible alternative to the traditional face-to-face classroom setting. EMS employees require a broad range of core competencies to perform their job effectively and the majority of these skill sets fall within the psychomotor domain of learning. This study showed that distance education, enhanced with multi-media technology, was as effective as face-to-face instruction in teaching a paramedical psychomotor skill. Implications include:

1. Cost effectiveness for instruction. Perraton as cited in Dhanarajan, Ip, Yuen, and Swales (1994) suggested that measurement of the cost effectiveness of distance education is difficult to ascertain, in part, from the pragmatic nature of accurate data collection and, in part, because there is more to assessing education than cost. Keegan (1996) specified that distance education systems tend to have high fixed costs but lower variable costs compared to a conventional education system. Keegan also purported that distance education benefits from economies of scale. In considering the use of technology to deliver distance education, Bates (1995) contended that the major cost for distance education is in the production costs. In context to this study, the Paramedic Academy offers approximately 30 face-to-face regionalized workshops yearly where there is the potential to teach the Sager Traction Splint. If one assumes it takes approximately two hours to teach the

Sager Traction Splint in a face-to-face format and that the instructors are getting paid approximately \$30/hour this works out to a cost of \$1800/year (30 X 2 X 30) to teach in the face-to-face format. The development and implementation of the Sager Traction Splint multi-media lesson plan cost approximately \$15000. Therefore gross costs would be recovered in just over eight years (\$15000 divided by \$1800). This calculation does not factor in variable cost savings such as student travel, meals, accommodation, facility rental, and utilities, which would further reduce the break-even point. Note that this is a very rough estimate as the researcher was not privy to budget data nor was it the intent of the study to examine fiscal implications. The Paramedic Academy has plans for further development of multi-media lesson plans and because the infrastructure is now in place, future costs for development and implementation will be further reduced.

2. Greater access to the training. "Technology adds choices as to how, when, and where students access learning opportunities" (Smith, 1997, p. 36). Offering distance education opportunities to the employees of the British Columbia Ambulance Service opened up training to those employees who reside in remote corners of the province. With assistance from technology the boundaries of learning are extended so that learning can occur not only in the classroom but from home or the workplace as well (Relan and Gillani as cited in Khan, 1997). The Sager Traction Splint is a patented device that is used widely by Emergency Medical Service organizations. Access to and distribution of the multi-media distance education package to other agencies



- would be relatively easy to do. As more multi-media lesson plans are developed there is potential to offer this educational service to other Emergency Medical Service organizations globally.
3. The ability to offer a variety of skills training. The foundation of paramedical training is around mastery of psychomotor competencies, therefore, the majority of these skills have the potential to be taught via distance education. Distance education skills' learning is compatible to what Knowles (1975) suggested adults want out of their education: relevance, experiential, and to be of immediate value. The autonomous nature of the multi-media lesson plan is conducive to self-directed learning and self-improvement which Pratt (1993) contended is meaningful to adult learners. The findings in this study would be applicable to any educational institution that teaches psychomotor skills to students.
  4. Consistency in training. The Paramedic Training Network has over 300 part-time and full-time instructors teaching around the province. Consistency in instructional delivery is a concern that can be minimized with the implementation of standardized distance education lesson plans. Consistent terminology, standardized cleaning and storing of equipment, and consistent demonstrations of all treatments, protocols, and procedures will improve overall patient care. The British Columbia Ambulance Service and the Paramedic Academy will know that every paramedic will be taught to specific criteria. This is important not only from a patient care point of view but from a medical/legal perspective as well. The purpose of this study was to compare

two instructional methodologies in teaching psychomotor skills and to determine if one was as effective as the other. This study did not try to prove that the media alone influences learning outcomes but that media as part of an instructional system, in this case a distance education format enhanced with multi-media technology could be as effective as a face-to-face classroom setting. As Clark (1994) suggested it was not the CD-ROM or the Internet that influenced learning but rather the instructional methods embedded in the technology.

5. Freeing up or reducing the amount of face-to-face contact with students. If students can be autonomous and independent in completing aspects of their paramedical training this will either allow for the reduction of face-to-face time spent with the students or allow for that time to be spent on other learning activities.

### RECOMMENDATIONS

Many of the instrumentation tools, such as the multi-media CD-ROM lesson plan, the criteria-referenced Sager Traction Splint checklists, evaluator guidelines, and the evaluator training were invaluable in conducting a fair and unbiased study. The cooperation between the British Columbia Ambulance Service and the Justice Institute of British Columbia allowed the complex logistical considerations of the study fall into place. The research time frame made the data collection achievable and the pilot study allowed for modifications. Recommendation: Familiarization with time management and project management software.

Control and or assessment of prior learning of the sample was a weakness. The sample was comprised of recruits entering into the British Columbia Ambulance Service with limited exposure to the Sager Traction Splinting device but there was no accounting for years of experience in the pre-hospital care field. Restriction to the multi-media CD-ROM lesson plan for the control group was not 100% reliable. Sample students had restricted access to the CD-ROM lesson plan and were asked verbally not to view the CD-ROM, but the study did rely on their honesty in this regard. Recommendation: The pre-testing of student's knowledge to help eliminate or at least account for variances in student performance. Tighter control over the access of instructional materials would help improve the reliability of data.

The geographical distribution of the sample across British Columbia into urban as well as rural communities did provide a legitimate cross sample of Emergency Medical Service (EMS) organizations. This did turn out to be a liability as well as four videotapes were lost in shipping. The majority of shipments went via courier but some went by regular Canada Post. Recommendation: Regardless of shipping medium used, ensure that all parcels are traceable.

The Sager Traction Splint only required 15 sub-competencies to master. Recommendation: Future research could focus around more complex psychomotor tasks, such as the starting of an intravenous, endotracheal intubation or emergency needle thoracentesis.

Evaluation of student performance focused solely on the application of the Sager Traction Splint. This study did not examine whether or not a student could correctly apply the Sager Traction Splint in context to a full ambulance call.

Recommendation: Further research could be conducted on the student's ability to incorporate learned psychomotor skills into full patient care scenarios.

This study examined a snapshot of student performance. Students were assessed early in their paramedic training as well as early in their paramedic career and no follow up assessment was done. Recommendation: Research could be conducted to compare the effectiveness of distance education versus face-to-face instruction in the student's ability to retain a psychomotor skill.

Educational institutions are looking at distance education as a potential cost saving measure to deliver quality education to greater numbers of students (Bates, 1995, Keegan, 1996, and Perraton as cited in Dhanarajan, Ip, Yuen, and Swales 1994). Recommendation: Further research into the cost effectiveness of delivering multi-media enhanced distance education via the Paramedic Training Network.

Feedback from the follow-up questionnaire indicated that even though students felt confident in their knowledge and skill in applying the Sager Traction Splint, the majority of the students would still prefer to learn in a face-to-face environment. Recommendation: Further research into student satisfaction when learning psychomotor skills via distance education.

## SUMMARY

Student performance, when taught with the multi-media distance education lesson plan, consistently showed better results on the majority of psychomotor sub-criteria over those students taught in a face-to-face setting. Statistical analysis, however, showed that there was no significant difference. Implications directly

related to the Paramedic Academy and to the British Columbia Ambulance Service include:

- Continued use of the Sager Traction Splint multi-media lesson plan to teach this core paramedical skill.
- All further design and implementation of multi-media enhanced distance education lesson plans are justified from a student performance perspective.
- The amount of face-to-face contact time with students should be examined for efficiencies.
- Further research should be considered into the ability of distance education to teach more complex or invasive pre-hospital psychomotor skills.

Results from this study have broader implications as well:

- The potential for the Paramedic Academy to offer or market distance education to other Emergency Medical Service organizations.
- The potential for any field to develop distance education lesson plans to instruct psychomotor skills.

In conclusion, it is hoped that this study will precipitate further development and implementation of psychomotor skills instruction in the field of distance education.

## REFERENCES

- Aukerman, M.E. (1986). Effectiveness of interactive video approach for CPR Certification of registered nurses (Doctoral dissertation, University of Pittsburgh, 1986). *Digital Dissertations*. Pub. No. AAT8620270.
- Baldwin, D., Hill, P., Hanson, G. (1991). Performance of psychomotor skills: A comparison of two teaching strategies. *Journal of Nursing Education*, 30, 367-370.
- Bates, A. (1995). *Technology, Open Learning and Distance Education*. New York: Routledge.
- Bazyk, S., Jeziorowski, J. (1989). Videotaped versus live instruction in demonstrating evaluation skills to occupational therapy students. *American Journal of Occupational Therapy*, 43, (7), 465-468.
- Best, J. (1970). *Research in Education* (2<sup>nd</sup> ed.). Englewood Cliffs, New Jersey: Prentice-Hall.
- Bloom, B., Krathwohl, D. (1956). Taxonomy of educational objectives: The classification of educational goals, by a committee of college and university examiners. *Handbook I: Cognitive Domain*. New York: Longmans, Green.

- Caffarella, R. (1993). Self-directed learning. In Merriam, S. (Ed.), *An Update on Adult Learning Theory* (pp.25-35), *New Directions for Adult and Continuing Education*, 57, spring 1993. San Francisco: Jossey-Bass.
- Clark, R. (1994). Media will never influence learning. *Educational Technology Research and Development*, 42, (2), 21-29.
- Collins, M. (1983). A critical analysis of competency-based systems in adult education. *Adult Education Quarterly*, 33, (3), 175-183.
- Dave, R. (1970). *Psychomotor levels in developing and writing behavioural objectives*. Tucson: Innovators Press.
- Dhanarajan, G., Ip, P.K., Yuen, K.S., Swales, C. (Eds.). (1994). *Economies of Distance Education*. Hong Kong: Open Learning Institute Press.
- Fulford, C., Zhang, S. (1993). Perceptions of interaction: The critical predictor in distance education. *The American Journal of Distance Education*, 7, (3), 8-21.
- Gagne, R. (1985). *The Conditions of Learning* (4<sup>th</sup> Edition). New York: Rinehart and Winston.

Garrison, D. (1992). Critical thinking and self-directed learning in adult education: An analysis of responsibility and control issues. *Adult Education Quarterly*, 42, 3, 136-148.

Grow, G. (1991). Teaching learners to be self-directed. *Adult Education Quarterly*, 41, 3, 125-149.

Hackman, M., Walker, K. (1990). Instructional communication in the televised classroom: The effects of system design and teacher immediacy on student learning and satisfaction. *Communication Education*, 39, 196-206.

Hall, W. (1994). Competency-based training and assessment. Review of research. National Centre for Vocational Educational Research. Leabrook, Australia.

Harrow, A. (1972). *A taxonomy of the psychomotor domain. A guide for developing behavioral objectives*. New York: McKay.

Hiemstra, R. (1993). Three underdeveloped models for adult learning. In Merriam, S. (Ed.), *An Update on Adult Learning Theory* (pp.25-35), *New Directions for Adult and Continuing Education*, 57, spring 1993. San Francisco: Jossey-Bass.

Keegan, D. (1996). *Foundations of Distance Education*. New York: Routledge.



Kerka, S. (1998). Competency-based education and training. Myths and realities.  
Office of Educational Research and Improvement. Washington, DC.

Khan, B. (Ed.). (1997). *Web-Based Instruction*. Englewood Cliffs, New Jersey:  
Education Technology Publications.

Kozma, R. (1994). A reply: Media and Methods. *Educational Technology Research  
and Development*, 42, (3), 11-13.

Knowles, M. (1975). *Self-Directed Learning*. Chicago: Follet.

Knowles, M. (1984). *The Adult Learner: A Neglected Species* (3<sup>rd</sup> Edition). Houston:  
Gulf Publishing.

Machtmes, K., Asher, J. (2000). A meta-analysis of the effectiveness of telecourses  
in distance education. *The American Journal of Distance Education*, 14, (1),  
27-46.

Mager, R. (1975). *Preparing Instructional Objectives* (2<sup>nd</sup> Edition). Belmont, CA:  
Lake Publishing.

Marteniuk, R. (1976). *Information Processing in Motor Skills*. New York: Holt,  
Rinehart and Winston.

Moore, A., Young, S. (1997). Clarifying the blurred image: Estimating the inter-rater reliability of performance assessments. Paper presented at the annual meeting of the Northern Rocky Mountain Educational Research Association. Jackson, WY.

Omoregie, M. (1997). Distance learning: An effective educational delivery system. Online. Available at: <http://www.webcom.com/journal/omoregie.html>

O'Neill, G. (1988). Teaching effectiveness: A review of the research. *Canadian Journal of Education*, 13, (1), 162-185.

Phipps, R., Merisotis, J. (1999). What's the difference? A review of contemporary research on the effectiveness of distance learning in higher education. Sponsor agency: The Institute for Higher Education Policy, Washington, DC.

Pratt, D. (1993). Andragogy after twenty-five years. In Merriam, S. (Ed.), *An Update on Adult Learning Theory* (pp.91-103). *New Directions for Adult and Continuing Education*, 57, spring 1993. San Francisco: Jossey-Bass.

Rekkedal, T. (1994). Research in distance education-past, present and the future. Online. Available at: <http://www.nettskolen.com/alle/forskning/29/intforsk.htm>

- Russell, T. (1999). *No Significant Difference Phenomenon*. North Carolina: North Carolina State University.
- Ryan, M., Carlton, K., Ali, N. (1999). Evaluation of traditional classroom teaching methods versus course delivery via the world wide web. *Journal of Nursing Education*, 38, (6), 272-277.
- Saba, F. (2000). Research in distance education. *International Review of Research in Open and Distance Learning* 1, (1), June 2000.
- Simpson, E. (1972). The classification of educational objective in the psychomotor domain. *In the psychomotor domain*. Washington, DC: Gryphon House.
- Singer, R. (1975). *Motor Learning and Human Performance* (2<sup>nd</sup> Edition). New York: Macmillan.
- Skinner, B. (1971). *Beyond Freedom and Dignity*. New York: Knopf.
- Smith, K. (1997). Preparing faculty for instructional technology: From education to development to creative independence. *Cause/Effect*, 20, (3), 36-44.
- Tennant, M., Pogson, P. (1995). *Learning and Change in the Adult Years*. San Francisco: Jossey-Bass.

Wetzel, D., Radtke, P., Stern, H. (1994). *Instructional effectiveness of video media*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Williams, A. (1992). *The efficacy of premium broadband video conferencing in teaching cardiac arrest skills: A comparative study*. Unpublished doctoral dissertation, Columbia Pacific University.

## **APPENDIX A**

Participant consent form.

Dear CMA 1 Student:

My name is Barrie Morrison, Regional Training Coordinator for the Cranbrook Training Region. As part of my master's thesis, and in conjunction with the Paramedic Academy and the British Columbia Ambulance Service, I am conducting an educational research project.

As a potential participant in this research project, I am requesting your permission to videotape your Sager Traction Splint evaluation. All videotapes will be held in strictest confidence.

The Sager Traction Splint evaluation checklists that will be utilized will be reviewed by your Lead Instructor or Regional Training Coordinator and put on your student file at the Paramedic Academy, as per standard procedure for all practical evaluations. In addition, I will also receive a copy of the evaluation checklist, which will be held in strictest confidence.

Once the research project is complete all videotapes and evaluation checklists that are in my possession will be destroyed.

Your cooperation and participation in this research will further enhance the ability of the Paramedic Academy to meet the training needs of the British Columbia Ambulance Service.

Yes, I **agree** to participate in the study \_\_\_\_\_ (print name)

\_\_\_\_\_ (signature)

No, I **do not agree** to participate in the study \_\_\_\_\_ (print name)

\_\_\_\_\_ (signature)

## **APPENDIX B**

Sager Traction Splint criterion-referenced checklist.

# Sager Traction Splint Evaluation Checklist

Student's Name \_\_\_\_\_

Student's Training Region \_\_\_\_\_

Date of Evaluation \_\_\_\_\_

Evaluators please circle which "Scenario" was used: 1      2      3      4

Action	Criteria	Eval	Comments
<b>Preparation</b>	1. Explains all actions and procedures to the patient.		
	2. Ensures ice is applied to the fracture site for ten minutes and then takes ice off for five minutes before re-applying.		
<b>Position</b>	3. Ensures the patient is positioned supine for the application of the splint.		
<b>Size</b>	4. Ensures the Sager Traction Splint is appropriately sized to the patient.		
<b>Splint Placement</b>	5. Places splint on medial aspect of the leg.		
	6. Slides thigh strap under leg without excessive movement or aggravation of the injury.		
	7. Instructs patient to inform of any discomfort while sliding the splint into the groin area.		
<b>Thigh Belt</b>	8. Secures thigh belt snugly without excessive movement or aggravation of the injury.		
<b>Ankle Harness</b>	9. Applies ankle harness to the injured leg above the malleoli and ensure a snug fit without excessive movement or aggravation of the injury.		
<b>Padding</b>	10. Ensures splint is adequately padded.		
<b>Traction</b>	11. Applies the appropriate amount of traction to the fractured leg.		
	12. Ankle strap does not slip down over malleoli.		
<b>Straps</b>	13. Applies three elasticized straps from stable to unstable.		
<b>Checks</b>	14. Rechecks distal circulation, sensation, and function after splinting.		
<b>Secures</b>	15. Pads between patient's legs and secures both limbs with triangular bandages or elasticized straps.		

**Additional Comments**



## **APPENDIX C**

### Student Performance Guidelines for Evaluating the Sager Traction Splint

# Student Performance Guidelines for Evaluating the Sager Traction Splint

These guidelines will provide the evaluator a reference to what is acceptable and what is unacceptable when marking the student applying the Sager Traction Splint.

## Documentation Guidelines

All evaluation must:

Be documented in ink and legible.

Use a “**checkmark**” beside any criteria item that is acceptable.

Use a clearly marked “**U**” beside any unacceptable criteria item.

Have an objective comment beside any unacceptable criteria item.

Use **N/O** for any criteria items that are not observed.

Be complete. Ensure that no criteria items are left blank.

## Acceptable Performance Guidelines

### Criteria Items Notes Acceptable behavior

<p>1. Explains all actions and procedures to the patient.</p>	<p>1. If the student gives a brief overview of what is going to occur to the patient before the splint is actually put on that is acceptable or if the student talks to the patient throughout the application of the splint that to, is acceptable.</p> <p>2. If there were no communication between the student and the patient this would be not acceptable.</p>	<p>Student must verbalize to the patient what he/she is doing during the application of the Sager Traction Splint.</p>
<p>2. Ensures ice is applied to the fracture site for ten minutes and then takes ice off for five minutes before re-applying.</p>	<p>1. The scenarios are set up so that the ice has already been on the patient's leg for 5 minutes. It is up to the evaluator to make sure the student is aware of this fact before the skill testing begins.</p> <p>2. This is a guideline and the evaluator should allow 2-3 minutes of flexibility.</p> <p>3. The student would be unacceptable if no ice was applied or if ice was applied but not removed.</p>	<p>To be acceptable the student must apply and remove ice from the fracture site according to the 10 minutes on, 5 minutes off guideline.</p>
<p>3. Ensures the patient is positioned supine for the application of the splint.</p>	<p>1. This is only applicable in Scenario 1 where the patient is initially found sitting.</p> <p>2. If the patient were left sitting during the entire application of the splint, this would be unacceptable.</p> <p>3. If the patient were left sitting during the application of "traction" and then laid supine</p>	<p>The student must position the patient supine to apply the Sager Traction Splint to be acceptable.</p>

	this still would be unacceptable, as the movement will affect the amount of traction on the leg.	
4. Ensures the Sager Traction Splint is appropriately sized to the patient.	1. This criteria item is outcome based. It does not matter how the student measures the splint or the actual timing of when the measurement occurs that is important but that in the end (before traction is applied) that the splint is positioned properly and is the correct length.	To be acceptable the student must have the splint sized so that it fits snugly into the patient's crotch and the traction wheel ends up 2-3 finger widths below the sole of the foot.
5. Places splint on medial aspect of the leg.	1. None of the scenarios require a lateral application.	To be acceptable the Sager Traction Splint must be applied to the medial aspect of the leg.
6. Slides thigh strap under leg without excessive movement or aggravation of the injury.	1. This criteria item is outcome based. It does not matter how the student gets the thigh strap into position as long as the leg is not moved excessively or the injury aggravated. 2. Excessive movement or injury aggravation is described as lifting the leg up to get the strap under, putting direct pressure on the fracture site, or not supporting the limb, either manual support or with adjuncts, while positioning the thigh strap.	To be acceptable the thigh strap must be positioned without excessive movement or aggravation of the injury.
7. Instructs patient to inform of any discomfort while sliding the splint into the groin area.	1. This criteria item is not time dependent. In other words the communication or explanation could occur anytime prior to the actual positioning of the splint. 2. This criteria item would be unacceptable if no communication or explanation is provided to the patient.	To be acceptable the student must communicate with the patient regarding the positioning of the splint into the groin.
8. Secures thigh belt snugly without excessive movement or aggravation of the injury.	1. Snug can be described as tight but comfortable. The evaluator should be able to tell just by looking at the thigh strap or by slipping your fingers underneath the strap.	To be acceptable the thigh belt must be snug and accomplished without excessive movement or aggravation of the injury.

	<p>2. This criteria item would be unacceptable if the thigh strap was obviously loose or not secured at all.</p> <p>1. The evaluator should be able to tell just by looking at the ankle harness or by attempting to slip your fingers underneath the strap; you should not be able to get your fingers underneath the strap.</p> <p>2. This criteria item would be unacceptable if the ankle harness was obviously loose or not secured at all.</p> <p>1. If there were any metal against skin this would be unacceptable.</p> <p>2. The Sager Traction Splints that will be used in evaluation may vary on the amount of pre-padding that they come with. The evaluator should stick with the above criteria.</p>	<p>To be acceptable the ankle strap must be snug and placed above the malleoli and accomplished without excessive movement or aggravation of the injury.</p> <p>To be acceptable the splint must be padded.</p>
<p>9. Applies ankle harness to the injured leg above the malleoli and ensures a tight fit without excessive movement or aggravation of the injury.</p> <p>10. Ensures splint is adequately padded.</p>	<p>1. For scenarios #1 and #2 the correct amount is 10% of the body weight up to a maximum of 10 pounds.</p> <p>2. For scenarios #3 and #4 the correct amount is 5 pounds.</p> <p>3. Two pounds either side of the correct amount would still be acceptable.</p> <p>4. When initially applying traction it would be unacceptable to go over 2 pounds the correct amount.</p> <p>1. This criteria item would be unacceptable if the ankle harness slips down onto the malleoli.</p> <p>1. The student would be acceptable if they applied the top strap first, middle strap and then the bottom strap.</p>	<p>To be acceptable the student must apply the correct amount of traction.</p> <p>To be acceptable the ankle harness must not slip down over the malleoli.</p> <p>To be acceptable the student must apply the 3 elasticized straps from stable to unstable.</p>
<p>11. Applies the appropriate amount of traction to the fractured leg.</p> <p>12. Ankle strap does not slip down over malleoli.</p> <p>13. Applies three elasticized straps from stable to unstable.</p>		

	<p>2. The student would be acceptable if they applied the top strap first, bottom strap and then the middle strap.</p> <p>3. All other combinations would be unacceptable.</p>	
<p>14. Rechecks distal circulation, sensation, and function after splinting.</p>	<p>1. The student must check all 3 criteria to be acceptable.</p> <p>2. To check circulation a pulse check or a capillary refill can be done.</p> <p>3. To check sensation the student simply has to ask if the patient can feel them touching their foot or toes. The student does not have to isolate individual toes for the patient to identify.</p> <p>4. To check function the student simply has to ask the patient to wiggle their toes.</p>	<p>To be acceptable the student must check distal circulation, sensation, and function in the injured leg.</p>
<p>15. Pads between patient's legs and secures both limbs with triangular bandages or elasticized straps.</p>	<p>1. This is an outcome based criteria item. It does not matter how the student accomplishes the task as long as the legs are padded and the legs are secured together.</p>	<p>To be acceptable the student must pad between the legs and then secure the legs together.</p>

## **APPENDIX D**

Procedural guidelines for the Paramedic Academy's Regional Training Coordinators

Re: Multi-Media Distance Education Experiment

Regional Training Coordinator

Thank you for agreeing to assist in the comparative analysis experiment between the traditional face-to-face instructional methodology and the use of multi-media enhanced distance education instructional methodology.

The experiment is examining if there is any significant difference in student achievement when the student is performing a psychomotor skill when the learning takes place solely via distance education. For the purpose of this experiment the Sager Traction Splint will be the skill analyzed.

The results of the experiment may play a significant role in how paramedical education and training occurs in the future.

As with any experiment, control is of utmost importance. Considerable effort has gone into ensuring the results of the experiment are unbiased and representative of students across the province. In this regard I am including specific instructions and directions for the Regional Training Coordinator to follow. I would appreciate it if you took every effort to accurately follow the directions. If you have any concerns or questions please do not hesitate to call or email me.

The students participating in the experiment are new recruits entering Fundamentals 110 of the P-1 program.

The students for the experiment are divided into “control” and “treatment” groups.

Each Regional Training Service will be assigned either a control or a treatment group of students. In other words you will not have a mixture of students from both experimental groups.

A control group will be students who will be taught using the traditional face-to-face instructional methodology of “Demonstrate, Describe, and Do”. Yourself or one of your sessional instructors will teach the Sager Traction Splint just as the lesson plan is laid out in the P-1 Instructor Guide. The control group of students will not have access to the multi-media CD-ROM. Their only form of instruction on the Sager Traction Splint will come from face-to-face instruction. This instruction will occur, as it normally does, at the Core Skills workshop. The only change to the normal flow of the workshop is that students will be evaluated on the Sager Traction Splint on day three of the workshop.

To restrict access to the Sager Traction Splint multi-media lesson plan I am requesting that when you hand out the Core Skills Study Guides after the Fundamentals workshop that you remove the CD-ROM. Students may still have



access to the CD-ROM's from previous students or at their ambulance stations but please request to the students not to view the multi-media lesson plan. This is very important because if they view the multi-media lesson plan then I have no idea on how effective either instructional methodology was.

A treatment group will be students who will be taught solely by the multi-media distance education package (Sager Traction Splint). Students must be informed at the Fundamentals 110 workshop or shortly thereafter, that on day one of Core Skills workshop they will be evaluated on the Sager Traction Splint. No face-to-face instruction will be provided to these students. That includes demonstrations, questions, tips, etc. This gives the students 3-4 weeks or more to proceed through the multi-media lesson plans. This does not mean that back at their ambulance station that they cannot practice the Sager Traction Splint.

I will inform you in advance on whether or not you have a control or treatment group of students.

All the students will be videotaped while being evaluated on the application of the Sager Traction Splint. This means that, depending on your class size, you will require two or three VHS video cameras and videotapes. I will coordinate this with yourself and the Stores Department at the Paramedic Academy.

These evaluation videotapes and the checklists will be collected by you and then forwarded on to me. After I receive all the videotapes another group of three evaluators will watch the videotapes and evaluate all the student's performances. These evaluators will not be aware of which students were subject to which instructional methodology. This ensures unbiased results.

Yourself and or sessional instructors, using criterion-referenced checklists will evaluate students. These checklists are slightly different than what is currently being used so I would recommend spending 5-10 minutes with your sessional instructors before the evaluations begin to review the checklists. I will be mailing you a supply of checklists well in advance of your workshop. Included with the checklists will be performance guidelines for the evaluators. This is simply a document that describes what is acceptable and not acceptable for each step of the Sager Traction Splint application.

There are some specific instructions regarding the videotaping of the students performance that will be required to ensure fair objective experimental results: The videotapes will be viewed and the students evaluated again therefore the camera should be focused in such a manner as to capture the student applying the Sager Traction Splint. Don't worry about the big picture; get the camera in nice and close. To do this have an extra student run the video camera. Do not attach the camera to a tripod. This allows the person operating the camera to move around and zoom in and out as required.

Once the Sager Traction Splint has been applied there needs to be a close up shot of the ankle harness, traction wheel, and a pan right up the full length of the splint so that the evaluator watching the video will have a clear picture of the student's performance.

Each student should be evaluated using a separate videotape. Make sure the student's name, training region, and the date are labeled on each videotape. The videotapes must be able to be matched with the print-based evaluations. I will be receiving approximately 45 videotapes and evaluations so it is very important that I keep everything organized.

Once the evaluations are complete please send the checklists and videotapes to me, care of my home address. Do not send the checklists or the videotapes back with the other P-1 student materials to the Paramedic Academy. The exception would be if a student were "incomplete" you would need to make a copy of the checklist to have on the student's file before forwarding it on to me.

Regarding student performance—if your local evaluator is satisfied with the student's performance then this information would need to be passed onto to whom ever is the Lead Instructor for the upcoming workshop. In other words, any student who is "complete" on their Sager Traction Splint evaluation would not have to be re-evaluated in the next workshop. If the student was "incomplete" treat the situation, as you normally would—remediate in the workshop or within 10 days post workshop. If by chance the student is incomplete on the second attempt then you need to contact the P-1 Program Coordinator and myself.

Barrie Morrison

Regional Training Coordinator: Cranbrook  
Justice Institute of BC: Paramedic Academy

## **APPENDIX E**

Overview of the Sager Traction Splint multi-media lesson plan

# Paramedic Academy Multi-media Lesson Plan Overview

The lessons follow a common structure. Each lesson contains the following main segment:

Introduction  
Equipment  
Patient Management  
Procedures  
Practice

## Introduction

The Introduction describes the main uses of the equipment or procedure and lists the learning objectives, skill, and knowledge prerequisites, and instructions for the lesson.

## Equipment

The Equipment section introduces you to the equipment used in the lesson. It will provide you with an overview of the equipment and help you learn about its parts and uses. This section generally contains the following segments:

**General characteristics**—describes the characteristics of the equipment.

**Types**—describes common types or sizes of the equipment that are used in the field.

**Parts**—the name, function, and location of various parts of the equipment.

**Storage**—where the equipment is found in the ambulance.

**Cleaning and disposal**—how to clean the equipment for reuse, or how to dispose of the equipment safely after use.

**Equipment review**—a short quiz to review the key points in this section. You must achieve 80% or you will be required to re-do the quiz.

## Patient Management

The Patient Management section describes how to manage your patient. You will learn when to use the equipment or procedure(s), and review any issues that may arise related to overall patient management. This section generally contains the following segments:

**Indications and Contraindications**—lists the specific conditions under which you can use or should not use the equipment or procedure.

**Patient Assessment Model**—describes at what point in an ambulance call you should use the equipment or procedure.

**Patient Management Issues**—describes any issues or complications that may arise when using the equipment or procedure. You will also learn about any special circumstances that may cause you to modify how you use the equipment or procedure.

**Patient Management Review**—a short quiz to review the key points in this section. You must achieve 80% or you will be required to re-do the quiz.

## Procedure

The Procedure(s) section shows how to perform the procedure(s). You will have an opportunity to see how it is used in a call, and to see the specific steps in the procedure(s). This section generally contains the following segments:

**Context Demonstration**—this video segment shows you the procedure being used in an ambulance call. The intent is to show you the procedure in realistic use, and how its use fits into the overall management of a patient.

**Procedure Demonstration**—this segment shows you a demonstration of a paramedic performing the procedure in isolation. This is performed at normal speed and there is no commentary.

**Sequencing Activity**—in this activity you will be presented with a series of images representing the steps in the procedure. Based on watching the demonstration, you should be able to place the images in the correct order.

**Procedure Steps**—the procedure is presented as a series of steps. You will see a short video clip of each step and hear narration describing the key points of performing the procedure. You may review and replay these steps.

**Procedure Review**—a short quiz to review the key points in this section. You must achieve 80% or you will be required to re-do the quiz.

## Practice

The Practice section gives you several activities to review and practice using the procedure and/or equipment. This section generally contains the following segments:

**Practice Demonstration**—this activity allows you to see and hear the steps of the procedure in a “full-screen” mode. You can choose to watch the procedure with a slight delay between steps, or to stop after each step. This allows you time to practice the step using the equipment.

**Evaluation Criteria**—in this activity you will read what experts and evaluators look for when they are marking a student. They describe how to tell whether or not you are performing a step correctly.

**Common Errors**—expert practitioners tell you about some of the common problems paramedics encounter when using the equipment or procedures. They show you some of the tips and tricks that they use in the field.

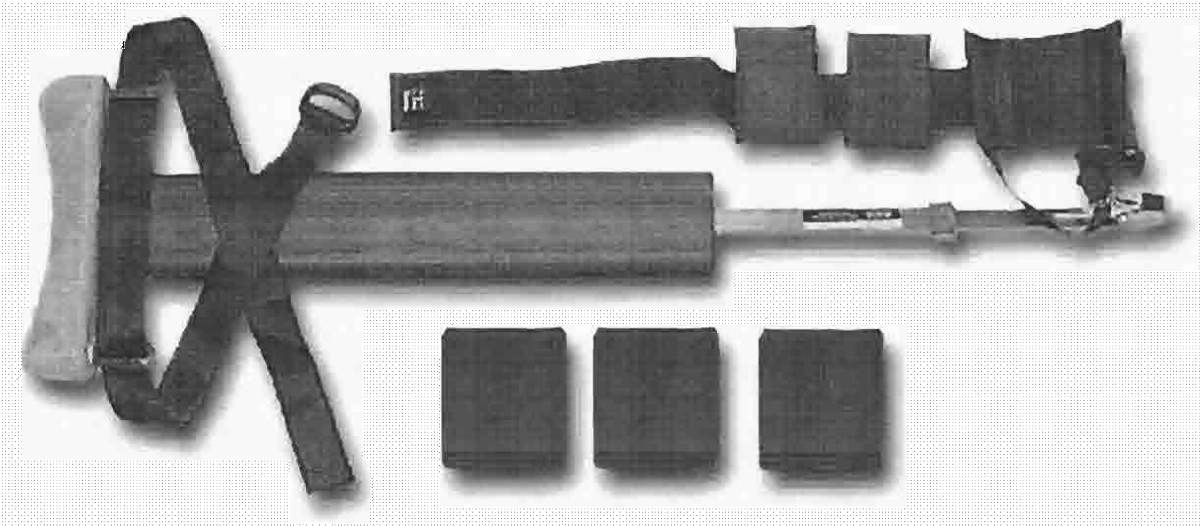
**Frequently Asked Questions**—the FAQ’s answer common questions that students ask. This segment clarifies key points and provides additional information about using the equipment or procedure.

**Practice Review**—a short quiz to review the key points in this section. You must achieve 80% or you will be required to re-do the quiz.

## **APPENDIX F**

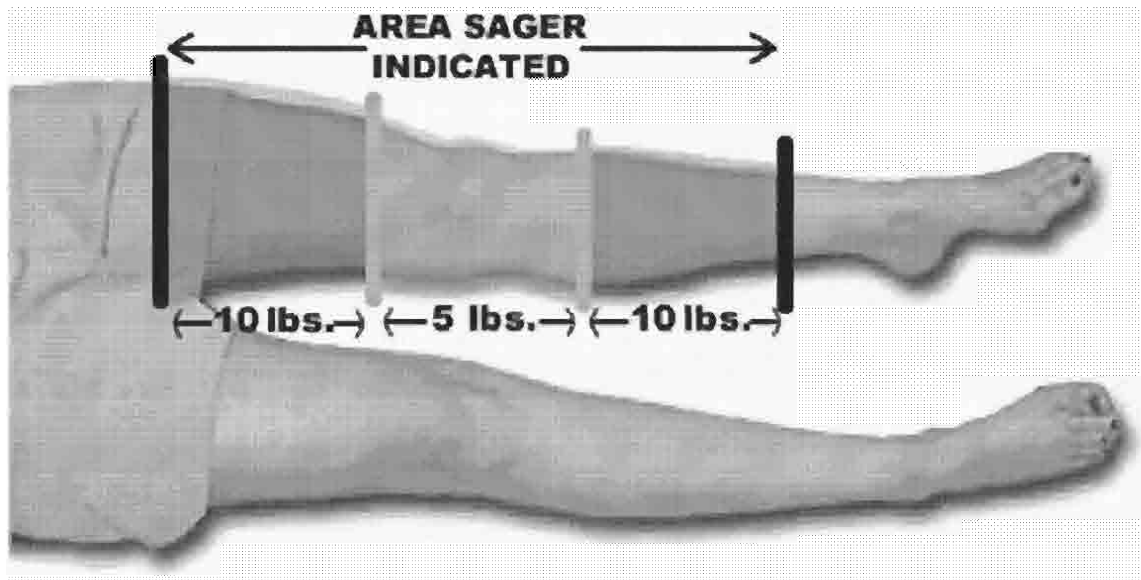
1. Graphic of a complete Sager Traction Splint.
2. Graphic of when the Sager Traction Splint would be indicated.
3. Graphic of Sager Traction Splint traction wheel depicting 4.5 kilograms (10 pounds) of traction

Graphic of a complete Sager Traction Splint





Graphic of when the Sager Traction Splint would be indicated



Graphic of Sager Traction Splint traction wheel depicting 4.5 kilograms (10 pounds) of traction



## **APPENDIX G**

Sample of a portion of the Multi-Media Screen Content Template used in the development of the multi-media lesson plan

SAMPLE OF A PORTION OF A MULTI-MEDIA SCREEN CONTENT TEMPLATE

Segment/Topic/Page	Content	Media/Notes
Introduction	Purpose	State the purpose—give a “hook” statement. Can be a mini-case or short introduction. Set the context for the lesson
Introduction	Pre-requisites	List the Pre-requisites: Skills and Knowledge that the student should have before using the lesson. Refer to the study guide module. Ensure that related objectives/skills required prior to this lesson are included.
Introduction	<p>Practice</p> <p>Once you are familiar with the equipment, patient management issues, and procedures, you can go to the practice section to review the material and maintain your competence in the use of the (Lesson Title)</p> <p>Equipment:</p> <ul style="list-style-type: none"> <li>A. – General characteristics</li> <li>B. – Types</li> <li>C. – Name, location, and function</li> <li>D. – Storage and use</li> <li>E. – Cleaning and disposal</li> <li>F. – Accessory supplies</li> <li>G. – Equipment review</li> </ul>	
Overview		Use this text and fill in Lesson Title name.

A- General characteristics		General description of the equipment.
B- Types		Include information on types, models, old/new versions/sizes. Description and, if necessary, photo/graphic of various types or styles of equipment. May be several pages long. Always start with most recent/most commonly used version, then show older or less used types.
C- Name, location, and function	Click on pins to learn the name and function of the main parts of the (Lesson Title)	This is the introduction to the NLF exercise and gives instructions.
D- Storage and use		<p>Overview of where you will find the equipment, how it is stored, and general information. Describe how the item(s) are packed. Are they stored in the open or are they packaged in some form of container.</p> <p>May include diagram or photo/graphic.</p>
E- Cleaning and disposal		<p>List common locations of the equipment.</p> <p>Procedures and policy regarding cleaning or disposal of the equipment. May be a text description (with graphic/photos, if required), or a video/audio segment.</p>
F- Accessory Supplies		<p>Are any other equipment or supplies used with this equipment? Where are they kept?</p> <p>May include photo/graphic.</p>
Equipment Review	You have completed the segment on Equipment	Review questions in multiple-choice format. Refer to Evaluation Blueprint for objectives to be reviewed.

## **APPENDIX H**

Sager Traction Splint patient scenario set-up

# Sager Traction Splint Evaluation

Evaluators please use one of the following four “Scenarios” for the Sager Traction Splint evaluation. Be sure to circle the appropriate Scenario Number on the top of the Sager Traction Splint Evaluation Checklist.

**Closed mid-shaft tibia/fibula fracture. Patient is sitting.**

**Closed mid-shaft femur fracture. Patient is supine.**

**Closed distal femur fracture (2 inches above the knee). Patient is supine.**

**Open mid-shaft tibia/fibula fracture (wound is on the anterior surface of the shin). Patient is supine.**

General comments to be provided to the student prior to starting the Sager Traction Splint evaluation:

- ❖ The evaluator is only marking the “skill” of applying a Sager Traction Splint.
- ❖ All Primary Survey and Secondary Survey patient assessments have been completed.
- ❖ Entonox has been applied.
- ❖ Ice has already been applied for approximately 5 minutes.
- ❖ Circulation, sensation, and function were checked during the patient assessment and were normal.

Scenario set-up:

For scenario #1 have the patient sitting, for all other scenarios have the patient lying supine.

- ❖ Have both shoes and socks off the patient’s feet.
- ❖ Have ice applied to the proper fracture site.
- ❖ Have sandbags in place on either side of the leg.
- ❖ For scenario #4 have the wound covered with a bandage and an elasticized strap.

## **APPENDIX I**

Follow-up student questionnaire



## Follow-up Questionnaire to your Sager Traction Splint Evaluation

Please answer the following 5 questions and then email your response back to me at: [bmorrison@jibc.bc.ca](mailto:bmorrison@jibc.bc.ca) or simply hit your "Reply" button, answer the questions and then hit "Send". Thank-you in advance. Barrie Morrison.

1. Approximately how much time did you put in to prepare for your Sager Traction Splint evaluation? This would include time spent completing the multi-media CD-ROM and any hands-on practice.
  - a) 0.5—1.0 hours
  - b) 1.0—2.0 hours
  - c) 2.0—3.0 hours
  - d) greater than 3 hours
  
2. Did you experience any technical problems that interfered with you completing the Sager Traction Splint multi-media lesson plan? If yes, briefly describe the technical problems and how they were overcome.

- a) No
- b) Yes.

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3. I prefer learning with the multi-media lesson plans to the traditional face-to-face instructional method.

Strongly agree.....Agree.....No difference.....Disagree.....Strongly disagree

4. Being videotaped during my evaluation affected my performance.

Strongly agree.....Agree.....No difference.....Disagree.....Strongly disagree

5. I feel confident in my knowledge and skill in applying the Sager Traction Splint.

Strongly agree.....Agree.....No difference.....Disagree.....Strongly disagree

## **APPENDIX J**

Feedback obtained from the conduction of a pilot study

## Pilot Study Results

1. Originally students in the control were just going to be notified via email not to view the multi-media lesson plans but it was revealed by the participants in the pilot study that a significant portion of them do not regularly check their employee email. It was decided that each Regional Training Coordinator or the researcher would follow-up with each participant in the control group advising them not to view the multi-media lesson plan.
2. Originally the video cameras were mounted on a tripod in a fixed position. The pilot survey revealed that to gather an accurate picture of the student's application of the Sager Traction Splint that the video camera needed to be mobile. With the camera in a fixed position students could inadvertently position themselves between the camera and the simulated patient rendering the assessment useless. By having the camera mobile this problem was eliminated.
3. It was also noted in the pilot study videotaping that it was difficult to accurately assess the amount of actual traction applied to the simulated patient's fractured leg. Because of this instructions were sent to the Regional Training Coordinators to inform them that the camera operator must zoom in on the Sager Traction Splint traction wheel so that the evaluator could clearly see the amount of traction that was applied. Again this minimized that problem.
4. The pilot study revealed that there was some minor confusion in tracking or matching the video taped assessments with the appropriate student. For the actual experiment a more formal tracking and cataloguing system was established.
5. For both the pilot study and the actual study students had the potential to be evaluated on one of four possible simulated patients. Each with a slightly different lower extremity fracture. The pilot study exposed the fact that each simulated patient was not being accurately set up and that the information provided to the student regarding what treatments and assessments have already been accomplished prior to being assessed was not consistent. From that standardized instructions were written and provided to the Regional Training Coordinator to ensure consistent simulated patient presentation.