

職能治療學會雜誌

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理事長序言

專業力=知識力

專業的價值，在於對社會國家乃至世界的專門貢獻，它必須被深厚的知識-且是可被驗證的知識所支撐。

臺灣職能治療學會第 15 屆理監事共識營中，確立本屆學會三大重點工作依序是：

- 一、 知識之發展與應用，包含創造、掌握、傳授與推展專業知識。
- 二、 突破現實環境中專業發展的限制與阻礙
- 三、 會務推動策略

「突破現實環境中專業發展的限制與阻礙」，靠的是專業的專門貢獻，須讓大眾認識職能治療專業的好用在哪？有用在哪？透過驗證後的專業知識，包含知識本體及應用型知識（如：治療手法或評估工具等），向大眾及團隊夥伴證明我們服務的正面價值。而「會務的推動」，其本質與活動方式重點也還是「創造、掌握、傳授與推展專業知識」及其實踐手段。

臺灣職能治療學會的使命與任務，便在於推動及促進專業知識的善用(轉譯)、發展及求證。

本屆學會專業品質委員會已規劃逐年建立臨床指引 (clinical guidelines)，透過知識檢證與匯集，發展供職能治療師在專業作業時引用與參考的知識工具。同時發展臨床紀錄範本，協助治療師保有操作過程產生的知識及應用的資訊，以備驗證療效。實習機構認證的推動一在配合考試院證照考試政策，建立職能治療實習品質基準；二在與職能治療服務單位對話，提醒在複雜的體系洪流中，促進專業堅守基準底線。

研究發展委員會及學術發展委員會將持續播種，將知識的種子和果實藉由繼續教育、論壇、研討會、演講、電子報、研究諮詢、網路平台、臺灣職能治療學會雜誌學術期刊等媒介，散佈到全國各地，讓耕耘專業福田的職能治療師有所本，有所仰視。創造專業知識的主角是每一位職能治療師、教師及學生，透過計劃或專案執行，在在都能轉型為知識產物，專業管理委員會

扮演彙整成果的角色。國際事務委員會也將借力於舉辦 2012 年臺灣臺北 WFOT Council Meeting 的機會，槓桿媒合國際專家資源挹注我國，齊生綜效。這一切的知識成果或經驗累積，都會委由專業推廣委員會收取溝通交流宣告之效，並透過衛福政策委員會向政府機關遊說建言納入制度，使職能治療專業能夠服務更多的族群與民眾。

知識的力量會不斷匯聚成專業的力量，這裡，有您我的一份力。

理事長 **蔡宜蓉** 謹識

主編的話

自今年度起，本人以誠惶誠恐的心情自主編羅鈞令老師的手中接任此新職，期望能在學術發展委員會主任委員謝清麟教授以及陣容堅強的編輯與審稿委員的協助下，讓職能治療雜誌繼續茁壯成長，以被「台灣社會科學引文索引資料庫」(TSSCI) 收錄做為未來努力的重點目標之一。此外，雜誌全體工作人員會持續秉持熱誠服務的理念，加快審稿速度，給投稿者具有建設性的修改建議，以及將這些精采的稿件準時於每年的 6 月與 12 月出刊，以饗讀者。

職能治療在台灣的發展已超過 50 年，培育了不少享譽國際的學者專家以及無數在各工作場所努力耕耘的職能治療人員。近幾年國內各 OT 系陸續成立碩、博士班，大幅提升研究風氣，以實證方式來支持臨床實務的觀察、評量與介入。不過較為可惜的是，這些寶貴的研究成果投稿到職能治療學會雜誌的數量仍是不多，也連帶影響學會雜誌在傳遞研究新知給讀者的時效性。

職能治療學會雜誌的質與量是衡量台灣職能治療專業領域的學術發展之重要指標。相信在全體會員的努力下，不久的將來學會雜誌必能成為一本有份量，被評鑑機構認可的優良雜誌，讓它成為大家的榮耀。

主編 蘇純瑩 謹識

Evidence for Practice: Research in Occupation, Health & Well-being

Keynote presentation at the TOTA Occupational Science Symposium III, 27 November 2010, Taipei, Taiwan

Ruth Zemke

Abstract

Since the beginning of the development of occupational science, occupational therapists have asked questions about its relationship with, contributions to, and research evidence produced useful to occupational therapy. To answer these questions with past and current research, I begin by reviewing basic scientific definitions, terminology, and conceptual models of health and occupation, and the early development of occupational science. Research on the essential elements of occupation is reviewed as a foundation for later translational research efforts. Finally, examples of occupation focused research evidence for occupational therapy practice is described. The need to understand the value of high quality non-traditional research evidence for optimal use in clinical reasoning is emphasized for future strength of the field of occupational therapy.

Keywords: *Occupational science, Occupational therapy, Evidence based practice*

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In the years that I and others have worked to develop occupational science, therapists have asked me many questions such as these: What is the relationship between occupational science and occupational therapy? What has occupational science contributed to occupational therapy? What research evidence about occupation is there, that occupational therapists should know about?

To try to offer my response to these questions, I'm need to start by reviewing some basic concepts.

1. What is Science?

As I see it, science is a form of knowledge based on theory and varying amounts of empirical data. In “doing science”, data (either experienced or observed) is collected and analyzed in a systematic & disciplined way. There are many approaches to and methods of data collection and analysis. In short, science includes theory and research in a process of looking for answers to questions in an organized way. The theory and knowledge of a science must be open to public review and discussion. That is, it gets disseminated, presented in appropriate forums, published, evaluated and criticized.

2. What is Theory?

According to Reed (1984), a theory is a set of interrelated assumptions, concepts, and definitions. A theory presents a view of phenomena describing the relationships between concepts. The purpose of theorizing is to describe, understand, explaining and predict the phenomena.

3. What are Models?

In developing theories we frequently use Models to help disseminate or teach our ideas. Models may be pictures (boxes, flow charts, arrows, etc.) or they may be presented in words that tell a story, or even in numbers (like algorithms or equations).

Conceptual models of occupation

The term occupation addresses what anthropologists call the activity

spectrum or stream, that is, the range of activities that fill the day for a given species (Moore, 1996, p.6). Occupational therapists and occupational scientists have described occupation as “the ordinary and familiar things that people do every day” (AOTA, 1995, p. 1015), “chunks of daily activity that can be named in the...culture” (Zemke & Clark, 1996, p.vii) and “all that people need, want, or are obliged to do” (Wilcock, 2006, p. 9).

Humans organize our actions in time and space, interacting with time and space through our daily activities, through our occupations. We can study occupation from both external and internal views. An external view of occupation looks at it from the outside, as an activity or an occupational form. In contrast, an internal view of occupation looks at the individual’s experience of engagement in an activity (Pierce, 2001).

These varied definitions tell us that occupation is viewed from many different perspectives. Examples of these perspectives include theories, conceptual models, and frameworks for practice, each of which provides a way of studying and researching occupation which has been useful to occupational therapists.

Gary Kielhofner, his students and colleagues have produced an outstanding body of theory and research based on the Model of Human Occupation (Kielhofner & Burke, 1985; Kielhofner, 1995) developing a framework for practice which is used internationally.

Theorizing regarding Occupational Adaptation (Schkade & Schultz, 1992; Schultz & Schkade, 1992; Schkade & Schultz, 2003) formed the basis for a research program for faculty and students of Jeanette Schkade and Sally Schultz, as well as a tool for improving clinical practice. The link between theory, models, research and practice is evident in their guide to practice (1992).

David Nelson’s development of the Conceptual Framework for Therapeutic Occupation (Nelson, 1988; Nelson & Jepson-Thomas, 2003) progressed from definition of concepts (concept isolating level of theory), to relating those concepts to each other (concept relating level), relating them to situations such as development, disease and disability (situation relating theory) and, finally, producing prescriptions for therapeutic action (practice theory) (Dickoff, James,

& Wiedenbach, 1968). His research and that of students and colleagues tested and further supported and shaped the model and clearly applied it to practice situations.

More recently, Michael Iwama presented the Kawa/River Model (Iwama, 2006) a model which developed from the work of a group of Japanese occupational therapy practitioners and which he believes provides a more culturally relevant model that better fits the day-to-day realities of their clients' lives. While grounded thoroughly in the life of the developers, it is just beginning to produce research data supporting the relationships of the concepts proposed. And that is another step in science. Theorizing and research are intertwined in the development of scientific knowledge.

The Canadian Model of Occupational Performance (CAOT, 1997) describes the dynamic relationship between people, environment and occupation. The environment is made up of physical, institutional, cultural and social elements, for example. Occupations are grouped as self-care, productivity, and leisure. The components of the person include affective, spiritual, cognitive and physical. The Canadian Occupational Performance Measure (COPM) (Law et al., 1991) has become a widely used clinical tool to begin therapeutic planning and study occupational outcomes of therapy.

Conceptual models of health

Just as theories, models and frameworks provide the basis for the scientific study of occupation, conceptual models of health provide a framework for selecting outcome measures when studying the phenomenon of health. Contemporary health models are moving away from a biomedical view to acknowledge the contribution of physical, social, and psychological well-being and emphasizing the importance of the interaction between the individual and the environment. These moves bring them much closer to our understanding of human occupation, as can be seen from the following examples.

The World Health Organization (WHO) has provided an internationally recognized definition since 1948: Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. This

definition provided the background for development of the WHO International Classification of Functioning (ICF) Model (2001) in which emphasis is placed on the influence of not only personal and but also environmental factors on three dimensions: body functions and structures, activities, and participation. Occupational therapists and scientists have found the dimensions of activities and participation to be closely related to our focus on occupation, and have tried to adapt the terminology for our own research purposes. Hemmingsson and Jonsson (2005) note these efforts, but comment on the ICF lack of inclusion of the subjective experience of meaning and autonomy.

And what is health to an occupational scientist? If we accept the premise that humans have an occupational nature important to our physical, mental and social well-being, then occupation is key to health. We can be healthy when our resources enable us to achieve our valued goals through occupational patterns of participation in our communities.

Following these definitions, then, our field's connection to health should be "therapeutic intervention that promotes health by enhancing the individual's skills, competence, and satisfaction in daily occupations" (Yerxa et al., 1990, p. 6). It is the application of an occupational focus rather than a medical focus to assist the people with whom we work to better meet their occupational needs.

Building a science

At the beginning of our field, the National Society for the Promotion of Occupational Therapy (1917) called for a science of occupation to advance "occupation as a therapeutic measure," to "study ... the effects of occupation upon the human being," and to disseminate "scientific knowledge of this subject" (Article 1, Section 3). Those who established the profession of occupational therapy recognized that, not only practicing occupational therapy, but doing research and disseminating it, was essential to the development of the field. While occupational therapy education moved ahead over time, improving occupational therapy practice, the field didn't make much progress in studying occupation or developing a science to disseminate knowledge about occupation.

The development of a science required that, in addition to theorizing and

model building, therapists gain the skills needed to carry out research focused on occupation. Research is the scientific study of data, that is, data collected, analyzed and shared according to rules in a systematic, rigorous, open way. Sciences are made up of varying amounts of abstract and grounded theory and models, with varying amounts of research supported data behind the knowledge that makes up the science.

The purposes of research are related to theory in two basic ways: One purpose (reflected in qualitative approaches to research) is to find data from which to build well grounded theory or models. Another purpose of research (in traditional quantitative experimental research) is to test relationships proposed in abstract theory or models.

Traditionally, research has been divided into two or three types, depending on the intention of the researcher (Gutman, 2009). Basic research is done to understand something, to develop new knowledge. It usually describes some aspect of a phenomenon and does not necessarily have immediate application. For example, one might describe an occupation and ask “What does it mean to people engaged in it”?

Translational research in medicine (“bench to bedside”) transforms such basic knowledge into new treatment ideas. In OT, we might think of it as, for example, testing models of occupational balance or Lifestyle Redesign for a new application.

Applied research is taking an idea developed in basic research, translated into potential treatment, and finally testing it with clients or patients (for example, Well Elderly Study I). This research can determine whether it is safe, satisfactory to patients, time and cost-efficient.

Early contributions of occupational science

With that background we have the terminology with which to discuss the development of occupational science and its contributions to occupational therapy. Initially, occupational science was described as “...the study of the human as an occupational being including the need for and capacity to engage in and orchestrate daily occupations in the environment over the lifespan” (Yerxa et al.,

1990, p. 6). Another early description stated that occupational science was "...the study of the form, function and meaning of occupation" (Clark, Wood & Larson, 1997).

Yerxa (1991) felt that the study of occupation required an alignment with values that she believed experimental research methods did not match, but which were matched by a variety of qualitative research methods. While colleagues supported developing the basic aspect of the science which was not directly applied to occupational therapy, they felt that the new science needed to be inclusive of translational and applied research and should include quantitative research methods as well as qualitative. Zemke (1989) had described research typologies as continua, not dichotomies, and noted that each project fell somewhere along continua on many characteristics of which basic to applied and qualitative to quantitative were not the only ones. Carlson and Clark (1991) emphasized that varied approaches and methods were needed to develop understanding of occupation in many ways. They felt that the best research approach depends on what is the best way to answer the research questions.

Not every element of current practice in occupational therapy is related to occupational science, however, occupational science research questions are those focused on occupation. Gray (1997) and Hocking (2000) suggested the development of knowledge about occupation would occur through research in three areas.

First, it was important to begin to identify the essence of occupation, the essential characteristics or qualities of occupations. That is, we must identify the nature, substrates, structure, features or characteristics of occupation (Gray, 1997; Hocking, 2000).

Secondly, we need to investigate the subjective experience, process, and outcomes of occupational performance. But, third, research also needs to explain how occupation relates to other concepts, including those important to occupational therapy, such as health, wellness, quality of life, or social structures and policies. These provide foundational relationships vital to planning occupational therapy treatment programs.

Occupational science for occupational therapy

According to Yerxa, by identifying and articulating a scientific foundation for practice, occupational science could provide practitioners with support for what

they do, justify the significance of occupational therapy to health, and differentiate occupational therapy from other disciplines (Yerxa et al., 1990, p. 3)

From the inception of the discipline of occupational science (Clark et al., 1991; Yerxa et al., 1990) the true intent of its founders was to nurture occupational therapy by generating knowledge that would enhance and substantiate the practice. It would do this by giving therapists a language, a more explicit understanding of the power of human occupation to health and well-being, and more relevant therapeutic approaches that lead to more potent outcomes in people's lives. All of these have the potential to sharpen occupational therapy's professional identity.

Occupational science was birthed to explore and manifest the philosophical roots of the occupational therapy profession (Molke, Laliberte-Rudman, & Polatajko, 2004). According to Burke (2003, p.33), "philosophical principles provide a platform for organizing both thinking and action....provide a system for ordering key ideas and the supporting evidence....feel confident that they share a common focus of concern...establish the parameters of inquiry, guide the development of a language to explain the phenomena of interest...and explain the methods that will be used...." Sharing these philosophical roots, occupational therapy can in turn support global occupational science research by providing examples of its application embedded in local social and cultural contexts in which therapy is practiced (Blanche & Henny-Kohler, 2000).

Research developed, some based on determining the essential elements of occupation, other work describing occupational engagement experiences and yet others testing or developing models or directions for occupational therapy practice. Molke et al. (2004) reviewed 54 occupational science documents published between 1990 and 2000 to describe the science's development and characterize how it had shaped its relationship to occupational therapy. In comparison to year 1990, year 2000 had four times the number of articles published, in three times the number of publications, with increased diversity in country of origin and academic discipline. Themes included exploration of human occupation, provision of a foundation for occupational therapy, defense of occupational therapy's epistemological foundation, and social reform related to occupation.

Glover (2009) reported a quantitative analysis of 244 articles in peer-reviewed journals in an overlapping time period: 1996-2006. She found that over that period of time scientists had significantly increased the number of articles and the proportion of empirical studies versus discussion of theory. The

articles, over time, had significantly increased notation of federal funding, suggesting increased realization of the importance of the problems studied by occupational scientists within the funding establishment. The development of knowledge about occupation has been carried out in many forms and at many levels. Even a brief review notes studies which have focused on the essential elements of occupation such as agency, temporality, place, and sociality. The process of occupation used as a therapeutic medium or outcome has also been explored some of this research will be presented in this brief review.

Research—essential elements of occupation

Occupation is agentic

According to the AOTA position paper on occupation (1995, p.1016), “occupation necessarily encompasses the required human capacities to act on the environment with intentionality” or agency. Agency within occupation gives us the potential of occupational choice, as people use their intentionality for engagement in chosen occupations to orchestrate a satisfying lifestyle.

I believe that different aspects of agency are seen in occupation:

1. Agency may be seen in choice. The individual may choose to engage in a new, novel, challenging, creative occupation. Such a choice usually requires a lot of conscious attention to the occupation and energy for the engagement.
2. The agency for occupational choice may be developed as a habit, in which we use routine to get occupations done.
3. Strategies for change may be needed to break old habits and occupational patterns, add new occupations to ones daily orchestration or modify the process of engagement in a familiar occupation. This form of agency requires regular attention and much energy, for example in individual’s adaptation to disability.

The participants in the Well-Elderly study combined these types of agency as they engaged in new occupations, in familiar occupations and also applied new strategies to familiar occupations to enable them to continue to participate in occupations with many levels of meaning to them, in spite of the changes of aging

(Jackson, Carlson, Mandel, Zemke & Clark, 1998; Mandel, Jackson, Zemke, Nelson, & Clark, 1999).

Crabtree's (2010) research synthesis from philosophy, psychology, neuroscience and occupation literature reviewed the concept of agency or intentionality. As the title, "No one dresses accidentally!" suggests, agency is still considered an essential element of occupation and occupational choice. According to the abstract, this synthesis examines these perspectives "as they relate to the concept of occupational performance and discusses the implications of intention for the therapeutic use of occupation, which ultimately include the need for occupational therapists to renew their professional focus on occupation as their single level of intervention" (p.100).

Occupations organize our relationship to time

The occupational organization of our temporality must acknowledge the biological, psychological and social nature of our use of time. But we need to explore the occupatio-temporality of our experiences also, exploring the occupational effects on subjective experience of time relative to clock time. These include the following comparisons between clock time and perceived time: Time passing may seem extended beyond clock time when waiting, or participating in boring occupations. Time may be perceived as compressed when carrying out habitual occupations. Our perception of clock time may be synchronic during familiar, routine occupations. Certain types of occupations which produce the sensation of "flow" (Csikszentmihalyi, 1990) seem timeless. These differing perceptions, based on qualities of the interaction between individual and environment through engagement in occupation allow us to consider the effect of options such as time shifting, changing our feelings about temporality by orchestrating daily occupations in a different way, or time deepening by becoming more fully focused on current occupations (Rechtschaffen, 1996).

Occupations organize our relationship to place

In Relph's (1976) classic presentation of the phenomenology of place, he identifies some of the essentials of the subjective experience of place which

makes it so different from our traditional ideas of environmental space.

1. It is usually, but not necessarily an identifiable geographic location. (Where am I when I am on the internet? Here? In cyberspace? Where is cyberspace?) Nomads take their “place” with them.
2. It has a landscape or appearance or some invisible constant that is recognizable (there is a “there” there) which may be natural, human made or just reflective of human values and intentions.
3. It is affected by time, culture and community.

But the essence of place is, as Relph noted, “Place is a centre of action and intention, it is a focus where we experience the meaningful events of our existence” (Relph, 1976, p.32). Those aspects of the world that we see as places involve a concentration of our purposes, our agency and our experiences of occupations engaged in there. Mayes, Cant, & Clemson (2010) noted that while occupational therapists are routinely involved in the homes of clients with disabilities providing consultation on the use and modification of space to improve functional independence, the meaning of home space is currently underexplored. They studied the meaning and use of home space for 80 mothers, primary caregivers for a child or adolescent with disabilities and high support needs. Access around the home for the family member with disabilities allowed mothers to combine caring with other home management activities. However, at the same time, preventing access or excluding the family member with a disability from some areas of the home enabled the mothers to resist the medicalization of their homes and create a personal space for themselves. Full accessibility within the home for the child with disabilities was rarely desired. According to Mayes et al. (2010) “decisions about the home and how it should be modified...become more complex when the needs of family members are taken into account. Meaning ascribed to space within the home is integral to how the space is used and whether a family member with a disability is included or excluded from the space. For occupational therapists, the meaning that clients and their families ascribe to various spaces within the home is as important as the use of space.” (abstract, p. 15).

For very old people living alone, Haak, Ivanoff, Fange, Sixsmith, & Iwarsson

(2007) focused on experiences of participation relative to the place called home. The researchers found that the home is the origin for participation both out of the home and within, but, as the participants' health declined, home became the explicit locus for participation. Participation changed from active participation in more physically demanding activities out of the home to participation as a spectator within the home. Appreciating self-defined goals for a meaningful life, while acknowledging realistic limitations, might better enable participation in very old age.

Occupations organize our social relationships

Recently, an entire issue of the *Journal of Occupational Science* focused on research and theoretical papers about the unique social relationship in co-occupations. Doris Pierce (2009) remembered how, as she began her work on her PhD in occupational science, she and her 3yr. old daughter would work/play together to clean up, picking up toys, they thought about a Sesame Street song; "Co-operation, makes it happen, co-operation, working together!" But, since Doris saw occupation everywhere, they sang "Co-occupation makes it happen, co-occupation working together!" Now 20 yrs later, the concept of co-occupation has lasted as a basis for research in occupational science.

"The co-occupation focus of this issue of the *JOS* marks a developmental milestone for the discipline. In regard to a concept original to occupational science, enough empirical work has been produced that a review of that literature can be used to refine our understanding. This is cause for celebration!" (Pierce, 2009, p.203-207).

The issue's articles focused on comparisons during solitary occupations and co-occupation of personality dimensions and behavior changes (Pizur-Barnekow & Knutson, 2009) and of physiological characteristics (Persch, Pizur-Barnekow, Cashin, & Pickens, 2009); descriptions of co-occupation in a day program for adults with developmental disabilities (Mahoney & Roberts, 2009), in promotion of occupational development (Price & Stephenson, 2009); and a case study of the intertwined occupations of an older couple after a stroke (van Nes, Runge, & Jonsson, 2009).

In yet another study of the effect on occupation and social relationships of disabling conditions, Cosby and Dunn (2010) investigated the impact of sensory processing disorders (SPD) on children's (ages 6-9) social participation patterns, compared to those of typically developing children. Their results found that the two groups of children had "generally similar patterns of activity preferences and use of free time but had significant differences in...intensity and enjoyment of involvement in their social networks" (p.462).

Occupational patterns organize time, space, and social relationships

Patterns are regular ways of acting or doing something which have been described at several levels including: Action patterns at the level of bodily and anatomical function, activity patterns at the level of the ability to perform activities, and occupational patterns at the level of participation. Bendixen et al. (2006) discusses patterns from a study of Scandinavian single students using time geographic methods—a graphic representation of diary information on time, place, occupation, etc. Now software is available to graph such data and print it out for discussion with research participants (or patients) for their own analysis/reaction. Their data suggest that human beings relate occupations and occupational patterns to occupational projects, where activities and occupations are interconnected and have a unifying goal that is given value by the individual and by the social environment.

Occupational scientists' research continues to link essential elements of occupation such as occupational patterns of temporality, place, sociality and link occupational patterns to other concepts including health/disease related ones. La Cour, Nordell, & Josephsson (2009) explored the experience of everyday occupations of 45 people with advanced cancer relative to time, location, and social engagement. The software program described by Bendixen et al. (2006) was combined with a constant comparative analysis of interviews. "The participants' days were spent mostly at home and were dominated by self-care and leisure, with social engagement limited to immediate family and close friends. The participants' daily rhythm was identified as closely linked to their experience of satisfaction and consisted of both routine and novel activities." (la Cour et al.,

2009 p. 154). It was suggested that there is a need to develop services to support people with severe illness in creating and maintaining personal rhythms of daily life that are satisfying.

Occupation focused evidence-based practice

Demands for increased accountability for health care expenditure, and recognition of clients' rights to interventions and methods of service delivery that are grounded in sound evidence, are compelling occupational therapists to continue to look for research findings, including those described above, to inform their clinical decision making.

Law and McColl (2010) carried out an intensive literature review of research meeting higher levels (I-IV) of the traditional medical research evidence hierarchy. One group of studies related to the outcomes of an individual's overall engagement in daily occupations (participation) within their living environment (e.g., self-management, personal care, community mobility, household and community-based tasks, and participation in social and community life).

Occupational therapy interventions that were used in the research focused on changing participation by changing body function/structure, improving client skills and performance, or optimizing participation in specific occupations. The majority of empirical studies and systematic reviews focused on the outcomes of participation in domestic life, mobility, and self-care. Examples of such research included the randomized controlled study by Yuen, Huang, Burik, & Smith (2008) in which participant residents in a long-term care facility's involvement in a volunteer program had a positive impact on their general well-being and acted as a protective factor against health deterioration. Review of work by Dooley and Hinojosa (2004) and Graff et al. (2006) provided support for occupational therapy intervention for patients with dementia including Alzheimer's, finding occupational therapy intervention increased quality of life and functioning for care recipient and caregiver support (e.g., decreased burden). In yet another study example, Gillen et al. (2007) found that practicing community skills in the environment outside the clinical setting allowed participants to better generalize

skills and increased function.

According to Law and McColl (2010) systematic reviews indicate that intervention that uses occupation enhances client motivation and leads to improved functional outcomes. Areas of participation where the evidence of effectiveness is strongest include the self-care, domestic life, major life areas, and community, social, and civic life. Occupational therapy intervention is effective in improving participation in daily occupations for adults across a range of diagnostic groups and in a variety of practice settings. However, Law and McColl remind us that the use of research results alone does not constitute evidence-based practice. “Research findings together with client goals and values and therapists’ clinical wisdom lead to best practices. In this way, evidence-based practice becomes a powerful tool that helps practitioners provide higher quality services for clients and their families.” (preface).

Polatajko (2007), in her editorial review of the 58 articles published in the Occupational Therapy Journal of Research (OTJR) between 2004-2007 found that while 57% of them were descriptive of issues of occupational performance, only 15% of the articles addressed issues of intervention related to occupation. Polatajko considered this picture to support the idea that the field’s move to occupation-based practice is well entrenched in research agenda (few studies of components (3%) had been published). But, she wondered what the barriers to producing good quality intervention studies were, and how occupational therapists could mobilize resources to support the research that is still needed.

Hammel (2001) proposed that occupational therapy's evidence-based practice needed to be ethically consistent with its client-centered philosophy. Echoing Yerxa’s (1991) earlier view, Hammel suggests that qualitative research methods may be most appropriate to identify and address client priorities. While in Hammell’s (and Yerxa’s) view, traditional quantitative research approaches render client voices silent, qualitative methods may enable occupational therapists to explore the complexities of clinical practice and of living with a disability, thereby informing a more client-centered, evidence-based practice of occupational therapy.

Tomlin and Borgetto (2011) noted that difficulties in locating, interpreting

and applying research evidence may be sources of negative perceptions of therapists toward EBP. However, they believe a more fundamental difficulty is that the theoretical structure of evidence-based practice that we have learned about does not yet align itself with the essential decision-making needs of practitioners. “Occupational therapists concern themselves with occupation and the lived experience of their clients. Their practice is one of dynamic interaction with clients, with a particular focus on outcomes in the real world of physical, social, and spiritual participation (p. 189). They note that medicine, psychology and education also find the challenge of appropriate evidence for their practice decisions not well met by the highly valued meta-analyses of classical experimental method’s blind, randomized controlled trials.

An alternative model of evidence (Tomlin & Borgetto, 2011) which values qualitative research and clinical outcome research at various levels of rigor, as equally informative as the traditional experimental controlled trials, enters into a state-of-the-art discussion going on in other fields including public health (Glasgow, Lichtenstein & Marcus, 2003). Occupational scientists and therapists are not alone in their efforts to find appropriately focused research to guide them in clinical reasoning and decision-making.

The task of building an occupational science is a big one. The benefits of that science are huge--to our patients, our field of practice and academic discipline, and to our societies. I have enjoyed a wonderful opportunity to practice, teach, guide, and encourage many in my occupational therapy career and share, collegially, my enthusiasm for this occupational science project with them. But there is much more building which needs to continue. Each of us, researcher, teacher, clinician, has a role in this effort. Teachers and researchers from many occupational science and therapy programs will continue as will the many practitioners who have learned to think about the importance of occupation in their life and that of their clients. All of these people will contribute to the work of developing occupational science internationally in the future.

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臨床實務的證據： 職能、健康與福祉的研究

OCCUPATIONAL THERAPY

Zuth Zemke

摘要

自職能科學發展以來，職能治療師常提出關於其與職能治療的關係，對於職能治療的貢獻以及其研究實證對於職能治療的用處等問題。為了回答這些問題，我首先在過去和現在的研究中回顧基礎科學的定義、專門用語、健康與職能的概念模式以及職能科學的早期發展。以職能的基本要素之研究結果做為未來轉譯研究的基石。最後，描述關於職能治療實務的以職能為焦點之研究實證，並強調：為提高職能治療專業未來的優勢，必須瞭解高品質的非傳統研究實證及其在臨床推理之最佳應用的重要性。

關鍵詞：職能科學、職能治療、實證實務

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Validation of the Ruff 2 and 7 Selective Attention Test for Outpatients With Schizophrenia

OCCUPATIONAL THERAPY

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Abstract

This study validated the use of the Ruff 2 & 7 Selective Attention Test in 40 outpatients with schizophrenia. Sixty-five to seventy-eight percent of the patients were impaired (defined as being more than one standard deviation below the normative mean) on measures of speed, but only 23.0-28.0% scored in the impaired range for accuracy. Patients were faster and more accurate in automatic detection rather than controlled search conditions. Females were significantly faster than males in visual search when the target discriminability was low. Age and education were not correlated with any of the 2 & 7 Test scores. There were significant positive associations between speed and accuracy measures and performance IQ. Speed scores were inversely related to negative symptoms, while accuracy had no correlation with symptom scores. These preliminary results demonstrate that the 2 & 7 Test is a valid instrument for assessing selective attention in outpatients with schizophrenia.

Keywords: Schizophrenia, Selective attention, Gender, Intelligence, Validity

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1. Introduction

Attention deficit represents one of fundamental dimensions of cognitive impairment in schizophrenia, particularly those related to sustained and selective attention (Filbey et al., 2008; Hagh-Shenas, Toobai, & Makaremi, 2002; Nuechterlein et al., 2004), and may contribute to impairments in high-level cognitive functions, such as verbal memory (BrébionGorman, Malaspina, & Amador, 2005), facial emotion recognition (Baudouin, Martin, Tiberghien, Verlut, & Franck, 2002), visual perception (Kahneman & Henik, 1981), and executive function (Breton et al., 2011). In addition, attention deficits have been associated with poor community functioning and lower social competence (Breton et al., 2011; Rempfer, Hamera, Brown, & Cromwell, 2003). Given its importance, attention processes are viewed as being among the key domains for assessing therapeutic effect of clinical trials in schizophrenia (Nuechterlein et al., 2008).

The Ruff 2 and 7 Selective Attention Test (2 & 7 Test) (Ruff & Allen, 1996) was developed to measure sustained and selective aspects of visual attention in people aged 16 through 70. It is based on the premise that automatic and effortful processing is responsible for the selection of specific stimuli for further processing (Cicerone & Azulay, 2002; Logan & Klapp, 1991; Logan & Stadler, 1991). The 2 & 7 Test is a cancellation type task that consists of a set of 20 blocks administered consecutively in 15-second intervals. For each block, the subject is required to cross out specific targets (always the numbers '2' and '7') while ignoring other letters or numbers. Two types of blocks are presented in the test: automatic detection (10 blocks), in which the target numbers are embedded among letters, and controlled search (10 blocks), in which the target numbers are intermixed with other numbers. Selection can be automatic, as in the search for the digits that seem to 'pop out' from a background of letters, or effortful, as in the search for the digits present among categorically similar nontargets (i.e., numbers) (Theeuwes, 1993; Treisman & Gelade, 1980).

Performance on the 2 & 7 Test is often reported to be scattered across several different sub-scores: speed, accuracy, and discrepancy. The speed score is the total number of target digits correctly detected in either automatic detection or controlled search block. The accuracy score, expressed as percentage, is the speed

scores plus error scores divided by the speed scores and then multiplied by 100. The discrepancy score quantifies the performance differences in speed and accuracy between automatic detection and controlled search blocks. Cutoff scores are established to define a significant discrepancy at various levels of significance (i.e., 10%, 5%, and 1%) (Ruff & Allen, 1996).

The 2 & 7 Test has been validated in healthy adults and those with neurological disorders, yielding strong test-retest reliability and good convergent validity (Baser & Ruff, 1987; Bate, Mathias, & Crawford, 2001; Messinis et al., 2007). Unfortunately, only one study has reported on the utility of the 2 & 7 Test in patients with schizophrenia (Weiss, 1996). Of these subjects, 67% had accuracy scores fall within 1 SD above or below the mean, while speed scores were in the normal range for only 23%. Automatic processing was faster and more accurate than controlled processing. Speed scores correlated moderately well ($r = .45$) with accuracy scores. Nonetheless, this study was restricted to men; the majority of them were inpatients. Clearly, more validity data are needed before the 2 & 7 Test can be used and interpreted with confidence in schizophrenia.

The 2 & 7 Test has many advantages as a screening measure (i.e. brief, easy to administer, easy to score, and minimal training on the part of examiners) and can be used in a variety of clinical populations that have a short attention span, including schizophrenia. Taking into account that there are limited data supporting the use of the 2 & 7 Test in outpatients with schizophrenia, the present study aimed to address this issue. Specifically, the purpose of the study was threefold: first to examine the pattern and magnitude of attention deficits on the 2 & 7 Test in schizophrenia outpatients; second to assess the effect of demographic and clinical variables on the 2 & 7 Test scores; and third to evaluate the relationship between the 2 & 7 Test measures and intelligence.

2. Methods

2.1. Participants

A convenience sampling method was used to recruit participants from an outpatient clinic of the Department of Psychiatry at a university hospital. Forty individuals (20 men and 20 women) who met the Diagnostic and Statistical

Manual of Mental Disorders, Fourth Edition (DSM-IV) (American Psychiatric Association, 1994) criteria for schizophrenia or schizoaffective disorder confirmed by the treating psychiatrists using the Structured Clinical Interview (SCID) (First, Spitzer, Gibbon, & Williams, 1996) and aged between 18 and 60 years agreed to participate in the study. Exclusion criteria included evidence of current substance abuse, mental retardation, or history of neurological illness and significant changes in clinical state or in drug treatment during the preceding 3 months. Written informed consent was obtained from each patient prior to data collection. This study was approved by the Kaohsiung Medical University Hospital Institutional Review Board.

2.2. Assessment

2.2.1. Intelligence

Wechsler Adult Intelligence Scale-Third Edition (WAIS-III) (Wechsler, 1997). The WAIS-III has two batteries of subtests grouped into two general areas: verbal scale and performance scale. Verbal scale is comprised of 6 subtests: Vocabulary, Similarities, Arithmetic, Digit Span, Information, and Comprehension subtests. Performance scale is composed of 5 subtests (Picture Completion, Digit Symbol-Coding, Block Design, Matrix Reasoning, and Picture Arrangement). A full-scale IQ is an aggregate of the VIQ-PIQ subtests. The WAIS-III includes four indexes based on factor analysis, namely verbal comprehension, perceptual organization, working memory, and processing speed. The factor indexes and IQ have a mean of 100 and a standard deviation of 15.

2.2.2. Symptom measure

The Positive and Negative Syndrome Scale (PANSS) (Kay, Fiszbein, & Opler, 1987). The PANSS is a 30-item rating scale assessing the presence/absence and severity of positive symptoms (seven items), negative symptoms (seven items), and general psychopathology (16 items) of schizophrenia. Each item is rated from 1 (no evidence) to 7 (extreme) based on objective criteria. Only scores on the positive and negative symptoms scales were used as dependent variables.

2.3. Procedure

In all subjects, demographic and clinical data were collected first, followed by the assessment of cognitive and psychiatric states. PANSS ratings were completed in a separate session by a board-certified psychiatrist within the same week as the cognitive evaluation. The cognitive tests were administered according to standard procedures by a trained Master's level examiner in a single session that lasted approximately 2 hours. Breaks were given where appropriate to minimize the effects of fatigue on performance.

2.4. Data analysis

Statistical analyses were performed with the Statistical Package for Social Science version 15.0 for Windows (SPSS, Chicago, IL, USA). Raw scores on the 2 & 7 Test were first converted into T scores, using published, demographically corrected norms provided in the manual. To determine the magnitude and pattern of attention deficits in our sample, performance on each of the 2 & 7 Test measures was compared with normative mean using one-sample *t*-test. To investigate the relation of the 2 & 7 Test scores to age, years of education, and clinical variables, Pearson's correlation coefficients were calculated. An independent samples *t*-test with Bonferroni correction ($p < .0125$) (alpha/number of tests) was applied to investigate if there were significant differences in the 2 & 7 Test scores between men and women. Finally, the relationship between the 2 & 7 Test and the WAIS-III was examined using Pearson's correlation. A widely accepted standard established by Cohen (1988), in which correlation coefficients of 0.1, 0.3, and 0.5 were considered as small, medium, and large, was used as a guideline to interpret the strength of correlation (*r*).

3. Results

3.1. Sample characteristics

Demographic and clinical features are presented in Table 1, along with the verbal, performance, and full scale IQ scores. Of these patients, 37 were diagnosed with schizophrenia and 3 with schizoaffective disorder. Patients with

schizophrenia were further classified as paranoid ($n = 27$) and undifferentiated ($n = 10$) by subtype diagnosis. All patients were right handed by self-report and were treated with either atypical or typical antipsychotics. The mean age of the patients was 38 years and the overall educational level was high: only 15.0% had a 9-year formal education or less.

As a group, the average full-scale IQ scores fell approximately one *SD* below normal (i.e. 85), yet 50.0% of the sample had preserved intellectual functioning. Verbal IQ scores were slightly higher than performance IQ. No significant differences were found in demographics, clinical severity, and IQ between male and female patients (Table 1). Likewise, the gender distribution did not differ significantly across the two subtypes of schizophrenia.

Table 1
Background characteristics for the total sample and for each gender

	Total ($n = 40$)	Males ($n = 20$)	Females ($n = 20$)	p^a
Age (years)	37.8 (8.6)	36.3(8.2)	39.3(8.9)	.23
Education (years)	12.2(1.9)	12.3(2.0)	12.1(1.9)	.62
Age at onset (years)	21.9(6.8)	20.9(5.8)	22.9(7.7)	.37
Number of hospitalizations	4.2(4.8)	5.0(6.1)	3.4(3.0)	.61
Duration of disease (years)	15.8(7.8)	15.3(8.1)	16.4(7.7)	.84
CPZeq (mg/day)	374.3(316.0)	394.9(274.1)	353.8(359.1)	.26
PANSS positive symptoms	14.4(4.7)	14.9(4.5)	13.9(5.0)	.39
PANSS negative symptoms	17.0(6.0)	18.0(6.9)	16.0(5.0)	.44
WAIS-III FSIQ	85.8(11.9)	85.3(12.4)	86.4(11.6)	.54
WAIS-III VIQ	87.8(13.0)	88.2(13.8)	87.4(12.4)	.90
WAIS-III PIQ	84.6(12.3)	82.5(12.9)	86.7(11.5)	.33
	Frequency (Proportion)			
Schizophrenia subtypes				.17
Paranoid	27(73.0%)	15(83.3%)	12(63.2%)	
Residual	10(27.0%)	3(16.7%)	7(36.8%)	

Note. CPZeq, Chlorpromazine equivalent; FSIQ, full scale intelligence quotient; PANSS, Positive and Negative Syndrome Scale; PIQ, performance intelligence quotient; VIQ, verbal intelligence quotient; WAIS-III, Wechsler Adult Intelligence Scale-Third Edition.

^aIn terms of gender differences in demographic, clinical and IQ characteristics, an independent samples *t*-test was used for continuous data, whereas the χ^2 test was employed for categorical data.

3.2. Performance on the 2 & 7 Test

The mean (*SD*) for each T score and the percent of patients showing impairment on the specific 2 & 7 Test measures are displayed in Table 2. Compared with normative T-score mean of 50, patients were significantly impaired on all measures except automatic detection accuracy. A paired *t*-test showed that automatic detection speed scores were significantly higher than controlled search speed scores ($t = 7.1, p < .001$), but no difference was found between the accuracy scores for automatic detection and controlled search conditions ($t = 1.5, p = .15$).

Concerning frequency of attention deficits, impairment was defined as a T score falling greater than 1 *SD* below the normative mean. 35.0% of the subjects scored within 1 *SD* above and below the mean on automatic detection speed, while 22.5% scored within the normative range (i.e. 40-60) on controlled search speed. 77.5% and 72.5% of the accuracy scores in the sample fell within the normal range for the automatic detection and controlled search trials, respectively. 55.0% of the patients met the discrepancy criterion for speed differences scores, while the percentage of patients meeting the discrepancy criterion for accuracy difference scores was 52.5%.

Of patients who scored in the impaired range on speed measures, 76.9% (20/26) and 71.0% (22/31) had accuracy scores within normal range on automatic detection and controlled search conditions, respectively. For those whose speed scores were within normal limits, 21.4% (3/14) and 22.2% (2/9) had impaired accuracy scores on automatic detection and controlled search, respectively.

Table 2
Descriptive statistics for 2 & 7 Test scores and percentage of patients impaired on each

Measures	T scores		<i>t</i> values ^a	<i>n</i> /% patients impaired ^b
	Mean	<i>SD</i>		
Automatic detection trial				
Speed	37.4	8.2	-9.7***	26/65.0
Accuracy	48.3	9.5	-1.1	9/22.5
Controlled search trial				
Speed	32.9	7.4	-14.7***	31/77.5
Accuracy	45.4	10.5	-2.8**	11/27.5

^aOne-sample *t*-test was used in the analysis.

^bImpairment was defined as a T score fell > 1*SD* below the normative mean of 50.

** $p < .01$. *** $p < .001$.

3.3. The effects of age, gender, and education on 2 & 7 Test performance

Table 3 showed that neither age nor years of education was significantly associated with the 2 & 7 Test scores. T-test results revealed significant gender differences in controlled search speed ($t = -3.4, p = .002$), but not in automatic detection speed ($t = -2.2, p = .03$), automatic detection accuracy ($t = 1.8, p = .08$) and controlled search accuracy ($t = 0.2, p = .86$). Females were significantly faster in controlled visual search than their male counterparts.

Table 3
Intercorrelations between 2 & 7 Test scores and age, education, and clinical parameters

	ADS	ADA	CSS	CSA
Age	-.17	-.23	-.04	-.01
Education	.22	.09	.14	.15
Age of onset	-.01	.01	.12	.25
Number of hospitalizations	-.24	-.01	-.09	.06
Illness duration	-.18	-.26	-.14	-.23
CPZeq (mg/day)	-.19	.02	-.25	-.03
PANSS positive symptoms	-.31	.18	-.29	-.15
PANSS negative symptoms	-.56***	-.07	-.53***	-.06

Note. ADA, Automatic detection accuracy; ADS, Automatic detection speed; CPZeq, Chlorpromazine equivalent; CSA, Controlled search accuracy; CSS, Controlled search speed; PANSS, Positive and Negative Syndrome Scale.

*** $p < .001$.

3.4. Association with clinical parameters

The 2 & 7 Test automatic detection and controlled search speed raw scores were highly associated with the PANSS negative symptoms, but not with the positive symptoms (Table 3). Accuracy scores for both trials were not significantly related to any of the symptoms. Neither speed nor accuracy scores correlated with age of onset, number of hospitalizations, duration of illness, and CPZeq.

Table 4
Pearson's correlations between 2 & 7 Test and WAIS-III

WAIS-III measures	ADS	ADA	CSS	CSA
Full scale IQ	.41**	.29	.46**	.37*
Verbal IQ	.28	.27	.30	.28
Performance IQ	.52**	.26	.58***	.42**
Verbal comprehension	.25	.22	.28	.32*
Perceptual organization	.43**	.28	.52**	.46**
Working memory	.27	.16	.32*	.22
Processing speed	.44**	.01	.54***	.30

Note. ADA, Automatic detection accuracy; ADS, Automatic detection speed; CSA, Controlled search accuracy; CSS, Controlled search speed; IQ, Intelligence quotient.

* $p < .05$. ** $p < .01$. *** $p < .001$.

3.5. Correlations with intelligence

As seen in Table 4, moderate to high correlations were found between 2 & 7 Test speed scores and all WAIS-III measures except verbal IQ and verbal comprehension. Controlled search accuracy was moderately associated with the full-scale IQ, performance IQ, verbal comprehension, and perceptual organization, whereas none of the WAIS-III measures were associated with the automatic detection accuracy.

4. Discussion

Over 65.0% of the patients showed impairment on the 2 & 7 Test speed measures, and the magnitude of these impairments increases as the effortful demands of the task increase. In contrast, accuracy measures were significantly poorer in only 23.0-28.0%. The accuracy performance did not seem to vary as a function of speed, as accuracy scores remained within normal limits in over 70.0% of the patients with either high or low speed scores. These results are in accordance with Weiss's (1996) assertion that patients with schizophrenia showed a general slowness in attentive processing during visual search, yet accuracy was much less affected. Several factors have been proposed to underlie deficient task performance in patients with schizophrenia, including impaired executive control (i.e., an ability to keep information in mind, inhibit irrelevant information and

adapt strategies to changing situational demands) (Gold, Fuller, Robinson, Braun, & Luck, 2007), less efficient perceptual grouping (i.e., the ability to group perceptually similar items together prior to the application of focused attention) (Place & Gilmore, 1980; Wells & Leventhal, 1984), a narrower visual span (Elahipanah, Christensen, & Reingold, 2010), and abnormalities in exploratory eye movements (i.e., duration of fixation and voluntary saccades) (Tonoya, Matsui, Kurachi, Kurokawa, & Sumiyoshi, 2002).

In agreement with attention-based theories of visual salience (Theeuwes, 1993; Treisman & Gelade, 1980) that posited a qualitative difference between parallel “automatic detection” and serial “controlled search”, a high percentage (over 50.0%) of patients had significant discrepancies in speed and accuracy difference scores between automatic detection and controlled search conditions. In other words, our patients were significantly faster and more accurate in searching for target stimuli that differ from the surrounding distractors in a salient manner.

There were no significant effects of age and education on speed scores. This finding is at variance with those previous normative studies (Messinis et al., 2007; Ruff & Allen, 1996) and may be attributed to our small sample with a restricted age and education range. In a similar vein, the finding that females excel on controlled search speed is in conflict with normative data from the general population (Messinis et al., 2007; Ruff & Allen, 1996). Research on gender differences in attention in schizophrenia is scarce and inconclusive. Some studies have determined that male patients tend to perform worse than female patients on tests of attention (Goldstein et al., 1998; Sota & Heinrichs, 2003), while others have shown the opposite or no differences (Albus et al., 1997; Goldberg et al., 1995). Methodological problems ranging from failure to control for probable confounding variables between the sexes, to the differences in attention measures used make it difficult to draw comparisons among studies. Considering that a much higher percentage of females (45.0-55.0%) than males (0-15.0%) scored within the normal range on speed measures who were matched for demographic and clinical variables, these gender differences cannot be attributed to mere chance. It is thus important to take gender effect into consideration when interpreting the 2 & 7 Test speed scores for patients with schizophrenia. Apart

from these, our data corroborate those of others (Messinis et al., 2007; Ruff & Allen, 1996), who failed to identify significant demographic effects on any accuracy scores.

The finding that speed scores were linked to negative symptoms concurs with several prior studies (Lysaker, Vohs, & Tsai, 2009; Nieuwenstein, Aleman, & de Haan, 2001) that have suggested that negative symptoms had varying degrees of impact on attention deficit in schizophrenia. The magnitude of correlations between positive symptoms and attention was in the small to moderate range, although not reaching statistical significance as sample size was small. This may imply a possible role of positive symptoms in speed of attention processing. Previous research has provided some evidence that negative and positive symptoms were differentially involved in search performance (Cornblatt, Lenzenweger, Dworkin, & Erlenmeyer-Kimling, 1985; Gaebel, 1989). Therefore, further work is recommended to ascertain the role of positive symptoms in selective attention using a large sample.

The 2 & 7 Test speed scores demonstrated the predicted relationships with several of WAIS-III scores. That is, patients with a higher performance IQ were faster in visual search than those with a lower IQ, and that the attention-IQ relationship was stronger in effortful processing tasks. There is abundant evidence that intelligence is closely related to different types of attention, including sustained attention, search, attention switching, and vigilance (Carlson, Jensen, & Widaman, 1983; Diascro & Brody, 1993; Schweizer, Moosbrugger, & Goldhammer, 2005). Limitations in attentional resources for the processing of visual information may compromise the quantity and effective allocation of cognitive resources that are necessary for optimal performance on high-level cognitive tasks (Treisman & Gelade, 1980).

Correlations between speed scores and the WAIS-III perceptual organization, working memory, and processing speed indices lend support to the theoretical underpinnings of the 2 & 7 Test and are consistent with other findings with respect to the relations between attention and the above-mentioned cognitive constructs in schizophrenia (Barch & Carter, 1998; Lee & Cheung, 2005). On the other hand, the finding that controlled search accuracy correlated with

performance IQ, but not verbal IQ accords with validation results of the 2& 7 Test (Ruff & Allen, 1996).

There are two limitations that need to be acknowledged and addressed regarding the present study. First, our sample size is considered relatively small, which restricts the generalization of results to the whole population of schizophrenic outpatients. A related limitation is that our small sample may result in limited statistical power to detect the effect of interest. This is important for valid interpretation of the relationship between several clinical variables (e.g., illness duration and positive symptoms) and attention performance. To achieve sufficient power (> 80%) at the 5% significance level for a medium effect size of 0.15, a sample size of approximately 76-91 cases is needed in future regression studies using 3 to 5 clinical predictors.

In sum, outpatients with schizophrenia displayed significant deficits in speed of attentional processing. Females performed faster than their male counterparts in controlled search trial. Negative symptoms and performance IQ were significantly associated with speed scores, while performance IQ was associated with controlled search accuracy. Though more large-scale research is warranted to confirm these findings, preliminary data suggest that the 2 & 7 test seemed to be valid as a quick screen for selective attention impairment in outpatients with schizophrenia. To provide further validity evidence for the 2 & 7 Test, future work is also recommended to assess responsiveness (defined as the ability of an instrument to detect clinically relevant change over time) for the test since attention deficit has been a target of cognitive rehabilitation in schizophrenia.

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羅夫2與7選擇性注意力測驗於 精神分裂症門診病患的效度研究

OCCUPATIONAL THERAPY

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摘要

本研究探討羅夫2與7選擇性注意力測驗於40名診斷為精神分裂症的門診病患之效度。當損傷標準被定義為低於常模平均數的1個標準差時，65-78%的病人在速度分數上達到損傷標準，相對的只有23-28%病人在正確分數上達到損傷標準。病人在自動偵測的測驗情境所表現的速度與正確度皆優於在控制搜索情境。女性在與目標類似的干擾刺激背景中（控制搜索情境），其目標刺激搜尋的速度快於男性。年齡與教育程度和羅夫2與7選擇性注意力測驗的各項分數並無顯著相關。速度與正確分數和作業智商有顯著正相關。速度分數與負性症狀呈現負相關，而正確分數與精神症狀之間並無顯著關係。這些初步結果顯示2與7選擇性注意力測驗能有效的使用於門診精神分裂症患者的選擇性注意力之評量。

關鍵詞：精神分裂症，選擇性注意力，性別，智力，效度

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The Relationship Between Visual Organization Ability and Activity Participation of Children With Down Syndrome

OCCUPATIONAL THERAPY

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Abstract

Previous work has highlighted that children diagnosed with Down syndrome (DS) may be at risk of developing visual perceptual problems. However, visual organization ability, one of the visual-perceptual functions, has not been well examined in DS to date. This study aimed to investigate the developmental profile of visual organization ability in children with DS; the effect of age on visual organization ability was also examined. The relationship between visual organization ability and activity participation was analyzed. Ninety-six children (50 boys, 40 girls) with DS (age range = 7yr 1mo to 14yr 10mo; mean age = 9yr 7mo) were assessed on measures of visual organization ability (Hooper Visual Organization Test), cognitive abilities (Wechsler Intelligence Scale for Children-Third Edition), and activity participation (Vineland Adaptive Behavior Scale). Results revealed the age-related improvements in body functions and correlations between specific body function (visual organization ability) and activity participation. Significant correlations among IQ and all other measures were noted. Our finding confirmed the role of visual organization ability on activity participation with DS. Interventions focused on improving body functions is needed while stressing the acquisition of functional skills that increased participation in age-appropriate activities

Keywords: Down syndrome, Visual organization ability, Activity participation

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1. Introduction

Down syndrome (DS) is a chromosomal anomaly that leaves the individual affected with an additional chromosome (the 21th) with occurrence in approximately 1/800 live births (Roizen, 2002). DS is the most common single cause of mild, moderate and severe intellectual disabilities (Menkes & Falk, 2005), with between 70% and 75% of individuals with DS attaining an IQ of between 25 and 50 by the first decade of life (Vicari, 2006).

Medical paradigms have undergone major changes during the past decades, and the concept of participation and function is becoming increasingly important in the field of childhood disability (King et al., 2007). The International Classification of Functioning, Disability and Health (ICF) model endorsed by the World Health Organization (WHO, 2001) defines participation as “involvement in life situations” resulting from the interaction of individuals with their social and physical environments. Participation in the everyday occupations of life is a vital part of human development and life experience through which we acquire skills and competencies, connect with others and find purpose and meaning in life (Law, 2002). Despite these shifts, there has been limited investigation into the activity performance and participation in children with DS, as measured by their adaptive functioning.

DS is associated with a distinct profile of developmental outcomes regarding body functions and activity performance (Fiddler, 2005), with evidence for great variation in the range and level of deficits resulting from biological and environmental factors (Turner & Alborz, 2003). In addition to significant limitations in intellectual functioning and adaptive behavior, children with DS also showed specific cognitive deficits on tasks requiring certain visual perception abilities including visual-motor integration, visual-spatial , and visual imagery abilities (Vicari, Bellucci, & Carlesimo, 2005; Visu-Perta, Benga, Incas, & Miclea, 2007; Wang, Wang, Huang, & Su, 2008). Difficulties with these visual perceptual tasks will interfere with their participation in school activities, including writing, literacy, and self care skills (Di Blasi, Elia, Buono, Ramkers, &

Di Nuovo, 2007), and these unsuccessful live experiences may further retard social and emotional development in these children (Weeks, Chua, & Elliott, 2000). As a consequence, it is crucial for clinicians and educational professionals who work with these children to screen for and treat visual perceptual problems.

Visual organization, one of the visual-perceptual abilities, refers to the capacity to mentally synthesize and construct pieces of visual information for use (Schulthesis, Caplan, Ricker, & Woessner, 2000). The building blocks of visual analysis and synthesis are established during infancy, and the pattern recognition and organization undergoes development across childhood (Kirk, 1992). Research has also documented that young children focus on specific features whereas older children use a more holistic, synthetic strategy when they organize fragments of visual information for identification. Visual organization ability is well developed and automatic in adults and a deficit in this capacity might reflect brain dysfunction (Kellman, Guttman, & Wickens, 2001). However, visual organization abilities and its developmental trajectory specific to the children with DS have not been properly investigated and are largely unknown.

Studies investigating the physical and neurodevelopmental profile of this syndrome often incorporate mixed-sex study groups, resulting in inconclusive evidence about sex differences in areas vital to participation (Leonard, Msall, Petterson, Tremont, & Leonard, 2002). The few existing studies investigating the holistic functional profile of children with DS have tended to investigate adult populations, even though all these children will display some form of intellectual disability resulting in the need of functional intervention (Dolva, Coster, & Lilja, 2004). Few studies have measured specific skills appropriate to the wide range of abilities presented by children with DS or reported attainment levels for children in different age groups (Turner & Albortz, 2003). There remains, therefore, a dearth of investigation into the functioning and participation of children with DS based on age-appropriate, socially acceptable activities.

Update information is needed to guide professionals and parents with regard to reasonable expectation. On the basis of the current international health paradigm, the aim of this study was two-fold. The first objective of the present study was to investigate the developmental continuum on measure of body

function (i.e. visual organization abilities) of children with DS, the effects of gender on visual organization ability was examined as well. The second objective was to examine the association between their body function variables (i.e. cognition, visual organization ability) and participation in activities.

2. Methods

2.1. Participants

Purposive sampling was employed to ensure that visual organization ability was represented from participants of differing age and gender of DS. The inclusion criteria were: (1) a diagnosis of DS determined by the board-certified physicians at local designated hospitals according to the standards put forth by the Department of Health in Taiwan; (2) between 7 and 15 years of age; (3) absence of cataracts or strabismus at the time of assessment; and (4) no serious emotional and/or behavioral problems. Excluded were participants who carried coexisting autism, cerebral palsy, blindness, deafness, and other severe sensory impairments in an attempt to minimize confounding of data. Also excluded were those with previous neurological disorders such as traumatic brain injury, muscular dystrophies, and epilepsy. A total of 136 children meet the study inclusion and exclusion criteria. An attempt was made to contact parents or primary caregivers of these children to explain the project and request consent. Of these, 96 (50 boys, 46 girls) agreed to participate. Average age of these children was 9 years 7 months (range = 7 yr 1mo to 14yr 10mo; $SD = 14.5$ months). The children were divided into the following three similarly sized age groups: youngest (7-8 yr) ($n = 29$; 15 males, 14 females; mean age = 6yr 10mo, $SD = 6.3$ mo); middle (9-10 yr) ($n = 31$; 16 males, 15 females; mean age = 9yr 3mo, $SD = 10.8$ mo) and oldest (11-15 yr) ($n = 36$; 19 males, 17 females; mean age = 11yr 11mo, $SD = 19.3$ mo). These age groups were selected because it seemed feasible to expect greater differences in groups of children between the ages of 6 to 8 years (younger preteens) and 9 to 10 years (older preteens) than in adolescents (Rihtman et al., 2010).

2.2. Instruments

2.2.1. Demographic questionnaire

This included data on family socio-demographic status, child's health status, medications, treatments and paramedical therapies.

2.2.2. Hooper Visual Organization Test (HVOT) (Hooper, 1983)

The HVOT is a well-known neuropsychological instrument and widely used to assess the visual organization, or visual-constructional abilities (Seidel, 1994). It consists of 30 drawings of commonly known objects and animals that have been cut into several pieces and rearranged, requiring mental rotation to identify and name the items. The HVOT has good psychometric characteristics. In brief, internal consistency for the HVOT was around .85 to .89 (Giannakou & Kosmidis, 2006; Merten & Beal, 2000), while the medium of interrater reliability was .99 (Lopez, Lara, & Oh, 2003). The test-retest coefficients ranged from .69 to .86 (Levin et al., 1991; Lezak, Howieson, & Loring, 2004). The HVOT also demonstrated moderate concurrent validity (Greve, Lindberg, Bianchini, & Adams, 2000; Johnstone & Wilhelm, 1997; Ricker & Axelrod, 1995) and discriminative validation (Lopez et al, 2003).

2.2.3. Vineland Adaptive Behavior Scale-Chinese Version (VABS-C) (Wu, Chang, Lu, & Chiu, 2004)

The VABS-C was translated from Vineland Adaptive Behavior Scale (Sparrow, Balla, & Cicchetti, 1984). This scale is a standardized and norm-referenced measure of personal and social skills for use in populations from birth to 18 years 11 months of age. This measure includes 577 items divided into four domains: communication (receptive, expressive, written), daily living skills (personal, domestic, community), socialization skills (interpersonal relationships, play and leisure time, coping skills), and motor skills (gross, fine). In the present study, the scale was completed by teacher report. This measure enables the

assessment of the construct of participation through its assessment of adaptive behavior, which is defined as the age-related performance of the daily activities required for personal and social sufficiency. Split-half reliability ranged from .91 to .99 and the test-retest reliability coefficient ranged from .62 to .95. Validity study conducted by the VABS-C author demonstrated good validity for the Chinese version (Wu et al., 2004).

2.2.4. Wechsler intelligence scale for children-third edition (WISC-III) (Wechsler, 1991)

The WISC-III is designed for ages 6 years 0 months to 16 years 11 months. The test consists of 13 subtests split into two scales: verbal and performance. Full scale IQ is a scaled score representing overall ability in both verbal and performance subtest measures. The WISC-III also yields four index scores, including verbal comprehension (VCI), perceptual organization (POI), freedom from distractibility (FDI) and processing speed (PSI). These indexes were based on extensive factor analyses and are thought to tap relatively distinct cognitive domains. In short, the VCI is a measure of general verbal skills, such as verbal fluency, ability to understand and use verbal reasoning, and verbal knowledge. The POI assesses ability to examine a problem, draw upon visual-motor and visual-spatial skills, organize thoughts, create solutions, and then test them. The FDI reflects attention, concentration, memory and numeracy, while the PSI assesses visual memory, planning, psychomotor speed and speed of mental operations (Kaufman, 1994). The WISC-III generates three IQ and four index scores which have a mean of 100 and a standard deviation of 15. Psychometric properties of the WISC-III have been well established. The Chinese version (Chen, 1997) was used in the study.

2.3. Procedure

This study was conducted during 2008-2010 after obtaining approval from the Institutional Review Board of the Kaohsiung Medical University Hospital. Participants were recruited from relevant educational and clinical sources. Twelve

schools and 4 agencies serving children with developmental disabilities located in southern Taiwan participated as educational sources. Clinical sources included the departments of rehabilitation medicine and pediatrics at three hospitals and 2 developmental centers in the metropolitan area. Parents who agreed to participate with their children in the study consented and filled out the demographic questionnaire. Information on IQ was based on the recently administered Chinese version of the WISC-III. The VABS was rated by the children's homeroom teachers. The investigator with 15 years of clinical experience in pediatric rehabilitation administered the HVOT to the children according to standardized procedures specified in the appropriate test manual. The test was then administered on an individual basis in quiet locations identified at each child's respective school or home and took approximately 35–40 min to complete. Children were not paid for their participation in the study.

2.4. Data analysis

SPSS15 (SPSS Inc., Chicago, IL, USA) was used for all analyses. Standard scores were used for all calculations incorporating the VABS and the WISC-III. Raw score was used for analyses incorporating the HVOT since raw score for this scale enabled a sensitive performance of comparisons across DS age and sex groups for this test (Wuang, Wang, & Su, 2010). Independent-Samples *t*-test was also performed to compare the HVOT total scores between 96 children with DS and 100 age and gender- matched typically developing children (48 females; mean age = 9yr 4mo, SD = 11.6mo) retrieved from a previous study (Wuang et al., 2010). The relations of age and the three measures (HVOT, WISC-III, and VABS) were examined by Pearson correlations. Pearson's coefficient correlations were also performed to assess the relation between WISC-III total IQ, HVOT total scores and overall activity participation (i.e. composite score of the VABS-C).

Multiple (2×3) analyses of variance (MANOVAS) were performed to assess the effects of age group, sex, and age-group \times sex interaction effects for the subtests of VABS and WISC-III. Two-way analyses of variance (ANOVAS) were conducted on the VABS and WISC-III composite scores. Effect sizes were ascertained by means of η^2 , which reflect the proportion of the total variance

attributed to or accounted for by an effect, with 0.01 reflecting a small effect size, 0.06 reflecting a medium effect size, and 0.14 reflecting a large effect size (Cohen, 1988). If the multivariate test indicated a significant group effect, follow-up univariate F-tests were performed with Scheffé post hoc comparisons. A type I error rate of .05 was used for all analyses.

3. Results

Of the total study sample ($n = 96$), 28 children (29%) had no congenital anomalies, 36 (38%) had cardiac anomalies, 16 (17%) had noncardiac anomalies, and 16 had both cardiac and noncardiac anomalies (17%). Independent-Samples t -test showed significant difference in HVOT performance between individuals with and without DS ($t_{195} = -9.887$, $p < .000$, Cohen $d = 0.42$).

Pearson coefficient correlations between age and the HVOT revealed significant correlation ($r = .59$, CI = 0.21-0.66). Pearson's coefficient correlations between age and the VABS and the WISC-III composites respectively, for the study group as a whole, revealed a moderately significant correlation (VABS: $r = .55$, CI = 0.20-0.50; WISC-III: $r = .50$, CI = 0.20-0.60). Pearson coefficient correlations between HVOT and the VABS domain and composite scores yielded significant correlations (communication: $r = .58$, CI = 0.31-0.75; daily living skill: $r = .50$, CI = 0.35-0.69; socialization: $r = .54$, CI = 0.41-0.63; motor skills: $r = .57$, CI = 0.27-0.70; composite: $r = .55$, CI = 0.29-0.72). The correlations between IQ and either the HVOT or the VABS domains are all in the moderate range (Table 1).

Table 1

Correlations between IQ, HVOT, and the VABS domains

Measure		WISC-III composite	HVOT
		r (95%CI)	r (95%CI)
HVOT		.69 (0.47-0.78)	–
VABS	Communication domain	.66 (0.45-0.77)	.58 (0.31-0.75)
	Daily living skills domain	.62 (0.46-0.71)	.50 (0.35-0.69)
	Socialization skills domain	.58 (0.39-0.68)	.54 (0.41-0.63)
	Motor skills domain	.59 (0.41-0.55)	.57 (0.27-0.70)
	Adaptive behavior composite	.66 (0.47-0.77)	.55 (0.29-0.72)

Note. HVOT, Hooper Visual Organization Test; VABS, Vineland Adaptive Behavior Scale; WISC-III, Wechsler Intelligence Scale for Children-Third Edition; CI, confidence interval.

To assess the effects of age group (three levels) and sex (two levels) on the four domains of the VABS (communication, daily living skills, socialization, and motor skills), a separate 2×3 MANOVA was performed. The results showed a significant main effect for age (Wilks' $\Lambda = 0.72$, $F[6,128] = 4.60$, $p = .02$, $\eta^2 = 0.12$) with a medium effect size, yet no significant sex effect (Wilks' $\Lambda = 1.82$, $F[6,128] = 2.60$, $p = .12$) or age \times sex interaction effect (Wilks' $\Lambda = 2.94$, $F[6,128] = 0.27$, $p = .81$) for the subdomains of this measure. To further investigate the main age effect, the between-subjects effects of the MANOVA model were analyzed. For all the four indices, significant age effects with medium effect sizes were found between the oldest and the middle group in daily living skills ($F[2,90] = 2.62$, $p = .03$, $\eta^2 = 0.11$) and socialization ($F[2,90] = 3.11$, $p = .02$, $\eta^2 = 0.10$), and between the oldest and the youngest group in four domains (communication: $F[2,90] = 4.33$, $p = .003$, $\eta^2 = 0.09$; daily living skills: $F[2,90] = 3.88$, $p = .007$, $\eta^2 = 0.10$; socialization: $F[2,90] = 4.12$, $p = .004$, $\eta^2 = 0.11$; motor skills: $F[2,90] = 4.29$, $p = .003$, $\eta^2 = 0.13$). The oldest group performed better than both the youngest and middle groups. There was no significant difference between the middle and youngest groups.

A two-way ANOVA was performed to analyze the effects of age group (three levels) and sex (two levels) on the test composite score of the VABS. Main effect was only found for age group ($F[2,90] = 4.40$, $p = .009$), and there was no significant effect for either sex ($F[1,90] = 0.01$, $p = .99$) or age \times sex interaction ($F[2,90] = 0.04$, $p = .96$). The mean scores and standard deviations on the four domains of VABS and four indices of WISC-III according to age and sex are presented in Table 2.

To assess the effects of age group (three levels) and sex (two levels) on the four indices of WISC-III (verbal comprehension, perceptual organization, freedom from distractibility, processing speed), a separate 2×3 MANOVA was performed. The results showed a significant main effect for age (Wilks' $\Lambda = 0.88$, $F[6,128] = 4.82$, $p = .01$, $\eta^2 = 0.32$) with a large effect size, yet no significant sex effect (Wilks' $\Lambda = 1.34$, $F[3,82] = 0.67$, $p = .80$) or age \times sex interaction effect (Wilks' $\Lambda = 1.12$, $F[6,128] = 1.55$, $p = .72$) for the subdomains of this measure. To further investigate the main age effect, the between-subjects effects of the MANOVA model were analyzed. For all the four indices, significant age effects with large effect sizes were found between the oldest and the middle group (VCI: $F[2,90] = 2.82$, $p = .03$, $\eta^2 = 0.2$; POI: $F[2,90] = 2.62$, $p = .03$, $\eta^2 = 0.15$; FDI: $F[2,90] = 1.11$, $p = .04$, $\eta^2 = 0.15$; PSI: $F[2,90] = 2.12$, $p = .04$, $\eta^2 = 0.20$) and between the oldest and the youngest group (VCI: $F[2,90] = 4.33$, $p = .003$, $\eta^2 =$

0.4; POI: $F[2,90] = 3.62, p = .009, \eta^2 = 0.25$; FDI: $F[2,90] = 3.82, p = .004, \eta^2 = 0.22$; PSI: $F[2,90] = 3.99, p = .003, \eta^2 = 0.30$). The oldest group performed better than both the youngest and middle groups. There was significant difference between the middle and youngest groups as well.

Table 2

Means (SD) on the HVOT, VABS and WISC-III according to age and gender

Measure	Subtest	Sex	Age groups			Total (<i>n</i> = 96)
			Youngest (<i>n</i> = 29)	Middle (<i>n</i> = 31)	Oldest (<i>n</i> = 36)	
HVOT	Total	Male	11.3 (4.6)	13.7 (3.8)	18.1 (5.0)	14.4 (6.5)
		Female	11.1 (4.2)	13.6 (4.5)	17.9 (5.5)	14.2 (5.8)
		Total	11.2 (4.3)	13.7 (4.8)	18.0 (6.3)	14.3 (6.3)
VABS	Communication	Male	42.7 (9.5)	49.0 (8.1)	52.7 (8.3)	48.1 (9.9)
		Female	44.6 (9.5)	52.0 (9.2)	56.8 (10.6)	51.1 (11.3)
		Total	47.5 (10.4)	50.5 (8.2)	54.8 (9.2)	49.6 (10.0)
	Daily living skills	Male	46.3 (9.8)	48.4 (11.1)	50.9 (9.2)	48.5 (11.4)
		Female	49.5 (9.2)	51.1 (8.4)	52.6 (11.0)	51.1 (11.9)
		Total	47.9 (10.6)	49.8 (12.0)	51.8 (13.1)	49.8 (9.2)
	Socialization	Male	52.0 (9.6)	56.1 (8.3)	60.9 (11.1)	56.0 (8.7)
		Female	54.1 (5.5)	58.2 (5.1)	62.1 (10.1)	58.1 (9.5)
		Total	53.1 (5.4)	57.2 (6.4)	61.1 (20.9)	57.1 (13.6)
	Motor skills	Male	49.0 (11.8)	52.1 (11.1)	54.5 (14.4)	51.9 (10.1)
		Female	50.0 (8.6)	51.8 (9.0)	53.7 (11.4)	51.8 (9.9)
		Total	49.5 (9.6)	52.5 (9.4)	50.8 (12.1)	51.8 (7.7)
WISC-III	Verbal comprehension	Male	54.8 (14.5)	55.4 (18.3)	59.8 (15.0)	56.7 (19.1)
		Female	55.0 (16.2)	56.3 (13.7)	60.0 (19.7)	57.1 (17.5)
		Total	54.9 (15.3)	55.9 (15.1)	59.9 (16.2)	56.9 (18.1)
	Perceptual organization	Male	52.0 (15.7)	52.2 (16.8)	56.7 (17.0)	53.6 (7.8)
		Female	51.9 (9.0)	51.1 (9.1)	55.7 (11.9)	52.9 (10.2)
		Total	51.9 (12.2)	51.7 (10.8)	56.2 (10.0)	53.3 (23.1)
	Freedom from distractibility	Male	58.1 (14.2)	60.2 (12.2)	62.7 (15.1)	60.3 (19.0)
		Female	58.1 (12.5)	60.4 (12.6)	62.0 (12.5)	60.2 (12.8)
		Total	58.1 (15.2)	60.3 (14.9)	62.4 (15.1)	60.3 (19.2)
	Processing speed	Male	51.1 (10.5)	50.5 (11.1)	54.2 (12.2)	51.9 (10.4)
		Female	51.9 (11.5)	51.6 (12.3)	53.4 (11.3)	52.3 (9.4)
		Total	51.5 (11.7)	51.1 (13.0)	53.8 (14.9)	52.1 (11.2)

Note. HVOT, Hooper Visual Organization Test; VABS, Vineland Adaptive Behavior Scale; WISC-III, Wechsler Intelligence Scale for Children-Third Edition.

A two-way ANOVA was performed to analyze the effects of age group (three levels) and sex (two levels) on the test composite score of the WISC-III. Main effect was only found for age group ($F[2,90] = 4.40, p = .009$), and there was no significant effect for either sex ($F[1,90] = 0.01, p = .99$) or age \times sex interaction ($F[2,90] = 1.52, p = .55$). The mean scores and standard deviations on the four domains of VABS and four indices of WISC-III according to age and sex are presented in Table 2.

4. Discussion

One of the study purposes was to assess the functional profile of 96 children with DS aged from 7 and 15 years. In comparison with typically functioning populations, the visual perceptual and visual-motor integration functions of individuals with DS has been reported to be impaired (Rihtman et al., 2010; Wuang et al., 2008). Our finding of significant difference of visual organization ability between groups (DS vs. typically developing children) supports this claim. The finding of significant correlation between age and the HVOT is probably attributable to improved maturity of visual organization ability (Kirk, 1992). The age-related improvement on the HVOT performance suggests that children with DS between 7 to 15 years show better visual synthetic ability and are better able to mentally rotate and organize pieces of visual information as they grow up. According to the test performance on HVOT (Kirk, 1992), children's capacity to identify common objects from fragmented visual information approached borderline adult levels (score = 20 to 24) by the age of 6; the boys attained adult performance levels (score = 25) by age 12, but the girls did not reach these adult levels at any age. In the oldest group (11-15 yr) of the present study, only 5 boys (26.3%) and 2 girls (11.8%) reached the adult level (≥ 25). Our findings suggest that visual organization ability may be related to the longer developmental course for both boys and girls in DS populations.

Our findings begin to shed light on the contribution of visual organization ability to successful participation in children with DS. The association found between HVOT test score and the scores of the child on teacher-reported measures of communication, daily living skill, socialization skill, and motor skills

support the existence of a connection between body functions and activity performance. Our finding of an association between IQ and all other measures (HVOT and adaptive behavior) is in accordance with previous findings stating that the IQ of children with DS is related to their success at implementing functional components and participating in specific activities (Carr, 2003; Dulaney & Tomporowski, 2000). This study showed that adaptive behaviors increase with age; in addition, functional attainments earned in childhood seem to be sustained into adulthood for children with DS (Brown, Greer, Aylward, & Hunt, 1990). Therefore, it is essential to provide functionally focused interventions from the earliest possible age in children with DS. This need for early intervention focusing on function is also supported by our finding that the adaptive behaviors and functional profile of children with DS does indeed improve with age.

Also noteworthy is our result of notable age group differences on the four indices of WISC-III; this finding may be due to development in cognitive skills, an interpretation that would explain the finding of group differences between the oldest and youngest groups (as well as between the oldest and the middle groups) on the WISC-III subtests. The suggestion of improved body function with age is further supported by the relationship found for the whole sample between age and scores on all subtests and composite of the WISC-III. This trend of a linear improvement in performance on WISC-III implies that, as they get older, children with DS show better verbal comprehension, perceptual organization, attention inhibition, and are better able to quicker process increasingly challenging properties. This may also imply that functional maturation of the brain stills continues in these children, but at a slower pace than that of typically developing children.

It is critical to find a way to bridge with activity participation since intervention programs for DS have traditionally emphasized body structures and functions (Rihtman et al., 2010). Base on the premise that more successful adaptive functioning may occur in children with the physical foundation of better functional components, it would be plausible to provide intervention directed at improving functional components while using these functions to create a bridge

with substantial participation in age-appropriate activities.

A number of limitations are evident in the present study. First, children with DS (or at younger age) may obtain low scores on the HVOT by virtue of their limited naming abilities, even if the primary perceptual functions that the HVOT purports to assess are intact. Modification of the test administration, for example, use of the multiple-choice response format (Schultheis et al., 2000) in the future study may help conducting a clearer assessment of visual organization ability when the naming demand is diminished. Second, since the scoring rules were modified to accommodate cultural variations in object familiarity and vocabulary acquisition, it should be cautious to use and interpret the test in children of other countries. Finally, this study used a cross-sectional study design that limits the interpretation of the developmental continuum of the child with DS; further research should seek to apply longitudinal study designs.

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唐氏症兒童視覺組織能力 與活動參與度相關性之研究

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摘要

唐氏症兒童是最常造成智能障礙的染色體異常疾病，近期的研究亦指出唐氏症兒童會出現不同的視知覺功能異常，然而探討唐氏症兒童的視覺組織能力之研究則闕如。因此本研究的目的為探討唐氏症兒童視覺組織能力之發展、及年齡與此項能力之相關性；另外也會同時檢視唐氏症兒童視覺組織能力與活動參與度之間的關係。96 位唐氏症兒童（50 位男生，40 位女生；年齡範圍為 7 歲 1 個月至 14 歲 10 個月，平均年齡為 9 歲 7 個月）參與研究，分別接受關於視覺組織能力（Hooper 視覺組織測驗）、認知能力（魏氏兒童智力測驗）及活動參與度（文蘭適應行為量表）之評量。結果顯示唐氏症兒童的視覺組織能力會隨著年齡增加而進步，而且也會與他們的活動參與度有顯著相關。其認知能力與 Hooper 視覺組織測驗、文蘭適應行為量表之分數也有顯著相關。因此在協助唐氏症兒童發展參與活動的功能技巧時，也必須同時強調改善基本的身體功能（例如視覺組織能力）。

關鍵詞：唐氏症，視覺組織能力，活動參與

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靠背高度對輪椅推進之生物力學影響分析

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摘要

理想的輪椅靠背高度應取決於使用者本身軀幹的控制能力，及對於輪椅推動活動量的多寡而定；而太高的輪椅靠背可能會妨礙上肢的活動，進而減低其輪椅推動的效果。據此，本研究的目的在於驗證不同輪椅靠背的高度，在不同推進速度的情境下，是否對使用者上肢的活動度，及推進力學與推進效益產生影響。本研究採用重複施測的方式，共三十位下肢癱瘓之脊髓損傷輪椅使用者參與實驗。受測者分別使用不同高度的靠背，在輪椅運動平台上各自進行兩種速度(0.9 m/s、1.3 m/s)的推進活動，過程中分別記錄上肢的運動學與動力學資料。利用雙因子重複量數變異數分析來驗證，以靠背高度及推進速度為主要影響因子，對於運動學與動力學資料等依變項的差異性。結果顯示，使用低於一半軀幹高的靠背時，因移除了靠背對上肢活動的限制，明顯可增加上肢向後伸展的角度($p = .03$)，增進了上肢推動時的活動度($p < .01$)，進而能有效的傳遞推進力量到輪圈上，避免無謂的施力浪費，提昇推進的機械效益($p = .02$)，並有效的減少重覆性的推動頻率($p = .02$)。在臨床應用上，針對具有軀幹控制能力，且經常性自主性推動輪椅的脊髓損傷患，可建議採用較低靠背的輪椅，來增進推動的效益，同時又避免因過高重覆性的輪椅推動，對上肢所誘發的續發性損傷。

關鍵詞：靠背，肩膀，生物力學，脊髓損傷

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前言

選擇一個適當的手動輪椅和舒適座椅系統對於脊髓損傷者是一個十分重要決定。由於手動輪椅使用者每天花了很多時間坐在他們的輪椅上 (Yang, Chang, Hsu, & Chang, 2009)，這些輪椅使用者應根據自己的體型，而選擇合身的輪椅以獲得最佳的舒適性。同時，亦透過適當調整輪椅的尺寸，可讓使用者坐起來更舒服，在操作輪椅移動時獲得更高效能的表現，並可減低對上肢肌肉骨骼系統的傷害。因此，不合身的輪椅會極度影響到輪椅使用者的舒適度、輪椅的操作性、及推動輪椅的效益。

在選擇合身的輪椅時，有幾個關鍵的輪椅尺寸規格是需要去考慮：一、座面寬度：主要是取決於使用者左右兩側臀寬外加 5 公分，做為選擇最合適輪椅尺寸的參考。Cooper 學者 (1998) 更進一步指出在不壓迫到股骨大轉子的情況之下，輪椅寬度應越窄越好，不但可方便使用者進出較狹窄的環境空間，亦可讓手部更容易接近手推輪圈，進而增進推進的效益。二、座面高度：常見輪椅的座面高度依不同廠牌產品，而會有從 30 公分至 60 公分不等的高度，其中最常見的高度則為 50 公分高。根據過去的研究發現，最合適的座面高度為讓使用者在身體坐挺的姿勢下，當手握於手推輪圈的最上方位置(即十二點鐘的方向)，手肘彎曲角度會呈現 100 到 120 度之間，此高度即是最合適的座面高度 (van der Woude et al., 2009; van der Woude, Veeger, Rozendal, & Sargeant, 1989)。三、座面深度：主要取決於由臀部的最後端至膝蓋脛窩處減除 5 公分，做為合適座面深度的參考，過深的座面會讓座面前端抵到膝蓋脛窩而引起不舒適，而過淺的座面會無法提供足夠的支撐面來分散臀部壓力 (Dudgeon & Deitz, 2007)。四、椅面角度(seat angle)：此角度是指椅面本身與水平面所產生的夾角。一般輪椅大多設計為零度，但運動型的輪椅可能高達 20 度之多。透過增加椅面的角度，會造成椅面前高後低的現象，可讓輪椅靠背與椅面之間對於骨盆產生夾擠的效果，進而增加使用者的軀幹穩定度。同時，因椅面後方較低，使用者坐下時，其座面高度會相對的下降，進而會改

變實際使用者座面高度現象。Samuelsson、Tropp、Nylander 與 Gerdle 學者 (2004) 指出透過改變 12 度的椅面角度，可明顯增加輪椅推進的角度及減低推進的頻率。五、椅背高度：主要取決於由臀部的最底端至肩胛骨下角的高度。Dudgeon 與 Deitz 學者 (2007) 建議可依據使用者的軀幹控制能力來區分最適合的椅背高度。若使用者完全無軀幹控制能力，則椅背高度須採用到肩膀上方的高度；若使用者僅有部份軀幹控制能力者，椅背高度建議採用到肩胛骨中間的位置；若使用者仍擁有軀幹控制能力者，椅背高度便可採用較低的高度，到肩胛骨下角高度即可。目前市售一般標準型的輪椅，其椅背高度大致介於 41 公分 (16 英吋) 高度，且兩邊的支架在椅背上方會延伸拉高向後彎屈而形成手推把。這一加高的手推把設計雖可方便照護者推移輪椅，但對於自行推動輪椅使用者，無形中著實加高了椅背高度，進而限制了在輪椅推進時上肢的可活動範圍，尤其是向後伸展去抓握手推輪圈的動作。因此，許多活動量需求較大的輪椅使用者，往往會偏愛採用具有較低椅背高度且不具有手推把設計的輪椅。

一個最佳的輪椅靠背高度應取決於輪椅使用者本身軀幹的控制能力，及對於輪椅推動活動量的多寡而定 (Cooper, 1998)。一般而言，越高的輪椅靠背，對於高階層脊髓損傷所導致缺乏軀幹控制能力或本身無法自主推動需依賴他人推動輪椅者，會是較好的選擇，因高度本身能提供較多的軀幹支撐來協助使用者穩固軀幹；但卻也因靠背太高限制住使用者上肢向後擺動的活動範圍，而可能減少手推輪椅時，手部可接觸輪圈的範圍，連帶減低推動時自主推動輪椅的效益。另一方面來說，越低的輪椅靠背高度，可讓使用者上肢較無受限的向後擺動，增加推動輪椅時上肢的活動範圍，進而增進輪椅推動效益，這對於低階層脊髓損傷者，且輪椅活動量有較大需求者應是較好的選擇；但反之，低靠背本身會提供較少的軀幹支撐性，因此使用者需大量靠自身控制能力來支撐並穩定軀幹，否則有背部懸空之感受。就作者們所知，至今尚無研究針對輪椅靠背高低對於輪椅推進活動的效益進行實證性的研究。

此外，在進行輪椅推動活動時，推動的生物力學會因推動速度的快慢而隨之改變。Vanlandewijck、Spaepen 與 Lysens 學者 (1994) 研究指出，當輪椅推動速度加快時，推動的頻率會隨之增快。Boninger、Cooper、Robertson、

Rudy 與 Shimada 學者 (1997) 研究亦指出，輪椅推動所施的力量會隨推動速度增快而加大。然輪椅使用者會因情境或活動的要求，調整輪椅推進的速度。因此，若要確認輪椅靠背高低對於輪椅推進活動的效益分析，則需要觀察該效益能否持續存在於不同速度的情境下，及探討靠背高度與推進速度是否產生交叉作用 (interaction effect) 效應。因此，本研究目的是探討不同輪椅靠背的高度在不同輪椅推進速度的情境下，是否對於輪椅使用者上肢的活動度，及推進力學與推進效益產生影響。研究假設為：對應使用一般高度的靠背情況下，脊髓損傷輪椅使用者，當使用較低的靠背高度時，在進行兩個不同推進速度的活動下，其上肢的活動範圍、推進的力學及效益表現會有顯著不同表現。

研究方法

一、參與者

本實驗採用方便取樣，共徵召 30 位 (男性 24 人，女性 6 人) 居住於高雄縣市地區之脊髓損傷患者參與實驗。參與研究前需符合下面收案條件始納入為受測者：(一)、目前以手推式輪椅為主要行動輔具；(二)、為胸椎第八節以下且在美國脊髓損傷協會 (American Spinal Injury Association, ASIA) 功能分類量表中，歸類為 A 與 B 級之脊髓損傷者。此外，若參與者即使符合收案條件，但有下面排除條件之一亦排除參與實驗：(一)、推動輪椅時會出現血壓或心臟不適等生理問題；(二)、上肢出現明顯疼痛而影響輪椅推進表現。本研究已經通過高雄醫學大學附設中和醫院「人體試驗委員會」審核通過，准許實施。受測者皆在充分告知施測流程、本身的權益與資料保密原則，並簽署受測者同意書後，始開始進行施測。本研究樣本平均年齡為 40.4 ± 9.3 歲，平均使用輪椅經驗為 11.7 ± 8.6 年，平均軀幹高 (在坐姿下，從兩邊肩峰的中點量至臀部最底處) 為 55 ± 6.3 公分，平均肩胛骨下角高 (在坐姿下，從兩邊肩胛骨下角的中點量至臀部最底處) 為 44.9 ± 3.3 公分。受測者脊髓損傷部位分別分佈於胸椎第八節到腰椎第四節。

二、量測設備

(一)、三維動作分析系統

採用六台紅外線動作分析攝影機 (Qualisys Motion Capture System, Gothenburg, Sweden) 去擷取受測者在輪椅推動活動時，分別貼於軀幹與上肢的反光球 (如圖 1 所示)。本實驗之反光球設置點是參考文獻針對於輪椅推動研究所使用之軀幹與上肢貼放位置 (Boninger et al., 1997; Desroches, Aissaoui, & Bourbonnais, 2006)，反光球皆為直徑 20 mm 圓形的球型，分別貼在受測者兩側上肢肩峰、鷹嘴突、肱骨外上髁、橈骨莖突、尺骨莖突、第三掌骨頭上、軀幹胸椎第二節、及胸骨前方貼上三個反光球用以協助建立軀幹本身的座標系統 (local coordinate system)。

(二)、智慧型輪椅推進系統

本實驗採用智慧型輪椅推進系統 SMART^{Wheel} (Three Rivers Holdings, LLC, Mesa, Arizona, USA) 作為輪椅推進時所產生的動力學分析儀器 (如圖 1 所示)。該系統可獨立裝卸到不同尺寸的輪椅，用以偵測推進時之力量 (水平分力 F_x 、垂直分力 F_y 與內外分力 F_z) 與相對應力矩 (內外力矩 M_x 、水平力矩 M_y 與前後力矩 M_z) (Cooper, Robertson, VanSickle, Boninger, & Shimada, 1997)，並以無線傳出方式傳輸力學與時間資料至電腦加以紀錄。

(三)、輪椅運動平台

輪椅運動平台為類似跑步機之運動系統，可利用外接控制器獨立調整不同速度 (極速為每秒 1.8 公尺) 及傾斜坡度 (最大坡度達 12 度)。透過在此輪椅運動平台進行輪椅推進活動，可讓研究者在有限的實驗室空間內進行各種模擬的動態輪椅推進活動。本研究設定為在零坡度情境上，分別進行 1.3 m/s 及 0.9 m/s 的輪椅推進活動，用以模擬輪椅使用者在平面上，兩種不同快慢速度推動的狀態。

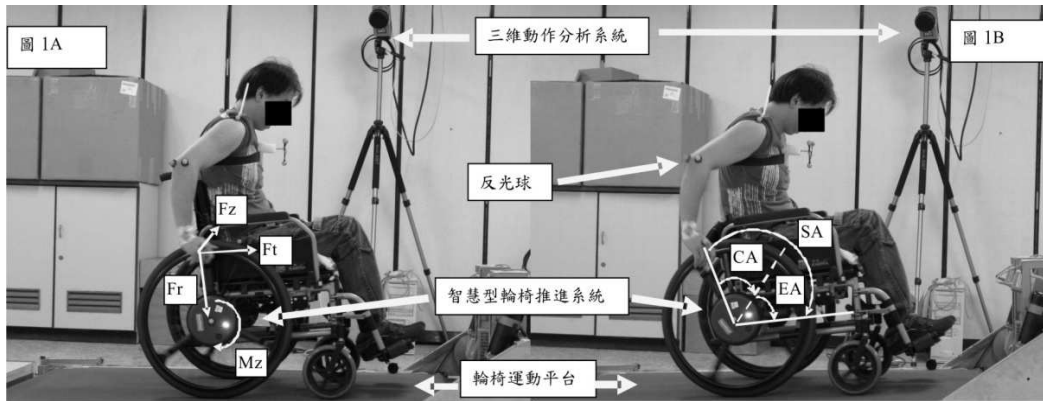


圖 1

在相同測驗情境下，輪椅使用者使用高靠背（圖 1A）相較於低靠背（圖 1B）進行輪椅推進實驗。Ft 代表切線分力，Fr 代表法線分力，Fz 代表向內分力，Mz 代表推進力矩，SA 代表手部接觸輪圈開始之角度，EA 代表手部離開輪圈之角度，CA 代表手部整體接觸輪圈之角度。

三、研究流程

在輪椅結構上，靠背骨架與座椅骨架是直接相連合成一體，左右兩端之間則安置網狀透氣尼龍布材質來形成座背墊，因此，輪椅靠背的寬度會與座寬一致。所以根據實驗受測者臀寬的大小，研究者會提供 16 吋或 18 吋座寬的脊髓損傷標準型輪椅（型號：KM-8520，康揚股份有限公司，台灣嘉義），讓受測者選用最符合自己體型來進行推進活動，共計有 28 位受測者使用 16 吋輪椅，而 2 位受測者則使用 18 吋座寬的輪椅。在選定合宜自身體型的輪椅寬度後，受測者會進行共計四次 30 秒的輪椅推進活動（兩種不同靠背高度 × 兩種不同推進速度）。輪椅推進活動分別有兩種不同的推進速度：（一）、在水平坡度情境下，維持以每秒 0.9 公尺速度推進輪椅 30 秒；（二）、在相同水平坡度情境下，維持以每秒 1.3 公尺速度推進輪椅 30 秒。而在每一個推進活動時，受測者會分別使用兩種不同靠背高度：（一）、高靠背，靠背高度為 40.6 公分（16 英吋）高，即是脊髓損傷標準型輪椅出廠時的高度設定。（二）、低靠背，靠背高度設定為受測者軀幹高度的 50%。因為至今尚無文獻指出最佳的低靠背的高度，我們參考目前運動型輪椅靠背的高度（如：歐風脊損型

KM-AT 20 靠背高度為 25 公分)，加上對照之前輪椅推進實驗受測者的人體測量資料（楊育昇、林素安、張志仲，民 99），而決定出此一高度的標準，其高度均低於本研究受測者的肩胛骨下角高度，約落於腰部上方的位置。為了能依據受測者不同的軀幹高度進行靠背高度的調整，本實驗用的輪椅僅靠背支持桿有經過改造，讓靠背高度得以有最大向下調整 30 公分的空間，其它後輪軸心位置、座面高度或座面角度皆沒有改變，以避免任何干擾效應。在完成兩次推進活動之間，會提供 5 分鐘的休息時間，以避免實驗受測者產生疲累的現象。當完成這兩次不同的推進活動後，輪椅的靠背高度會更換成另一不同的高度。至於進行推進測驗的速度及更換採用高靠背或低靠背的前後順序，則採電腦程式隨機抽樣決定之。

四、資料處理

本研究資料處理可分為運動學參數與動力學參數兩大部分。在運動學參數部份，包含輪椅推進時肩膀最大伸直角度 (shoulder maximal extension angle)、推進時肩膀最大外展角度 (shoulder maximal abduction angle)、推進時肩膀進行向前彎後伸的活動度 (flexion-extension range of motion)，外展內展的活動度 (abduction-adduction range of motion)，推進時手部接觸輪圈之開始角度 (Start angle, SA)、離開輪圈之角度 (End angle, EA)、接觸角度 (Contact angle, CA)、及推進速度。在動力學參數部份，則包含輪椅推進時所施之總合力 (Resultant force)，切線分力 (Tangential force, Ft)、法線分力 (Radial force, Fr)、推進力矩 (Mz)、推進功率 (Power) 及機械效益 (Mechanical effective force, MEF)。以下將分別描述各運動學參數以及動力學參數之計算公式。

(一)、肩膀關節活動度

本研究利用手肘、肩峰、軀幹胸椎第二節、及胸骨前方的反光球，根據 Koontz、Cooper、Boninger、Souza 與 Fay 學者 (2002) 針對輪椅推進過程中，計算肩膀關節活動度的方法，先定義出肩膀區部座標系統 (shoulder local

coordinate system)、軀幹區部座標系統 (trunk local coordinate system) 在絕對參考系統 (globe coordinate system) 中的位置與方向。透過軀幹區部座標系統在絕對參考系統 XYZ 軸的單位向量 (unit vector)，可以求出遠端之肩膀區部座標系統在絕對參考系統 XYZ 軸的單位向量，因而進一步計算出相鄰的遠端之肩膀肢體相對於近端之軀幹的相對移動角度。計算結果包括肩膀彎曲伸直 (flexion-extension) 角度、肩膀外展內展 (abduction-adduction) 角度、肩膀水平彎曲 (horizontal flexion) 角度。

(二)、手部接觸輪圈之開始角度、離開角度及接觸角度

透過以第三掌骨頭反光球的位置，再搭配使用智慧型輪椅推進系統偵測輪圈受力與否，來決定手部動作位置是否位於接觸或離開輪圈 (Cooper et al., 1997)。根據此位置與輪椅本身空間相對位置關係 (如圖 1B 所示)，即可求得手部接觸輪圈開始之角度 (SA)、手部離開輪圈之角度 (EA) 及手部整體接觸輪圈之角度 (CA)。詳細計算過程可參考作者們之前的相關研究 (楊育昇等人，民 99)。

(三)、動力學參數

透過智慧型輪椅推進系統(如圖 1A 所示)，所測得手部施於輪圈之水平分力 (F_x)、垂直分力 (F_y)、內外分力 (F_z) 及輪軸推進力距 (M_z)，可透過公式分別求得總合施力 (F_{total})、切線分力 (F_t)、法線分力 (F_r)、向內分力 (Medial force, F_z)、推進功率 (Power) 以及機械效益 (MEF)。在此要特別說明，機械效益是代表有效向前推進施力 (即切線分力) 與總施力的比率，代表向前推進力量之有效分配的程度，其單位為百分比，詳細計算公式可參考先前文獻或作者們之前的相關研究 (Boninger et al., 1997; Cooper et al., 1997; Yang, Koontz, Triolo, Cooper, & Boninger, 2009; 楊育昇等人，民 99)。此外，輪椅使用者本身的體重亦可能會影響到推進力量大小；因為在向前推動時，輪椅輪子與接觸面所產生的摩擦力會抵消部份的前進推動施力，而此摩擦力又與使用者本身體重所造成的正向力息息相關。所以體重越重的輪椅使用者

有可能會出現較大前進推動施力，以克服與地面所產生的摩擦力。在本研究資料分析中，亦發現不論是使用高靠背或低靠背，在任何快速度或低速度推進情況下，實驗參與者本身的體重與前進推動的總合施力皆呈現高度正相關 ($r > .6, p < .01$)。因此，就總合施力、切線分力、法線分力、與向內分力這些變項，我們進一步以體重倍率 (% body weight) 作為標準化 (normalization) 後，再進行統計資料分析。

五、資料分析

應用統計軟體 SPSS 11.5 版 (SPSS Inc., Chicago, IL, USA) 進行資料統計分析。為了檢驗研究假說，透過重複量數雙因子變異數分析 (two-way repeated-measures ANOVA) 來檢定當使用不同靠背高度及不同輪椅推進速度時，對於各項運動學及動力學表現差異。本研究採雙尾檢定，顯著水準 α 設為 .05。

結果

一、不同靠背高度與速度對於推進時運動學與動力學表現之交叉作用 (interaction effect) 分析

從表 1 及表 2 中得知，不論是在運動學表現上或者是在動力學表現上，所有依變項參數皆未受到因不同靠背高度與推進速度之交叉作用影響。因此，我們可單獨分別討論不同靠背高度或不同速度對於輪椅推進時之運動學與動力學表現之主要效果。

二、不同靠背高度對於推進時運動學、動力學表現之主要效果 (main effect) 分析

從表 1 中得知，在運動學表現上，相較於使用高靠背情況下，當受試者使用低靠背時，不論在慢速度或快速度情境下，使用者皆顯著出現較大的肩膀向後伸直的角度 ($p = .03$)，這一結果表示在推進時，使用者的手臂可以擺盪到較身體後方的位置進行推進輪椅活動。也正因此的改變，當受試者使用低靠背時，其肩膀的前彎後伸的活動度也顯著出現較大的角度 ($p < .01$)。但若從正面觀察，低靠背並不會明顯影響受試者在推進時肩膀外展的角度 ($p = .20$) 及整體外展內縮的角度 ($p = .36$)。此外，使用低靠背時，手部接觸輪圈之開始角度也顯著較大 ($p < .01$)，表示在推進輪椅時，手部開始接觸輪圈位置位於輪圈較後方，但在手部接觸輪圈之離開角度 ($p = .93$)並未達到顯著性的差異，然在整體上，手部接觸輪圈的角度卻仍會出現顯著較大改變 ($p < .01$)，推進頻率亦出現顯著較少的次數 ($p = .02$)，這表示在推進輪椅時，手部重覆性推動的動作可以明顯減低，仍可達到相同推進活動的需求。

表 1

使用不同靠背高度在不同速度下，進行輪椅動進活動時運動學參數之平均值與標準差摘要表

運動學參數 (單位)	靠背	0.9 m/s	1.3 m/s	高度之主 要效果 p -value	速度之主 要效果 p -value	交叉作用 p -value
推進速度 (公尺/秒)	高	0.9 ± 0.1	1.3 ± 0.0	.72	<.01**	.55
	低	0.9 ± 0.1	1.3 ± 0.0			
推進頻率 (次/秒)	高	1.2 ± 0.3	1.4 ± 0.4	.02*	<.01**	.55
	低	1.1 ± 0.3	1.3 ± 0.3			
肩膀最大伸 直角度(度)	高	43.1 ± 7.0	44.4 ± 6.7	.03*	.03*	.97
	低	46.8 ± 7.2	48.0 ± 6.4			
肩膀前彎後伸 的活動度(度)	高	50.0 ± 13.0	53.2 ± 12.9	<.01**	<.01**	.71
	低	54.3 ± 12.9	57.9 ± 12.1			
肩膀最大外展 角度(度)	高	47.9 ± 7.3	48.3 ± 7.7	.20	.73	.54
	低	43.7 ± 12.5	42.3 ± 16.2			
肩膀外展內縮 的活動度(度)	高	13.0 ± 4.7	13.7 ± 4.7	.36	.08	.75
	低	13.7 ± 4.3	14.6 ± 5.2			
手部開始角度 (度)	高	100.7 ± 12.0	102.7 ± 12.7	<.01**	<.01**	.72
	低	107.0 ± 13.3	108.5 ± 11.1			
手部離開角度 (度)	高	38.8 ± 10.9	36.8 ± 10.3	.93	.19	.63
	低	38.6 ± 9.0	37.8 ± 8.9			
手部接觸角度 (度)	高	61.9 ± 16.0	65.4 ± 17.4	<.01**	<.01**	.47
	低	68.4 ± 14.0	70.7 ± 13.0	.72	<.01**	

註：* $p < .05$. ** $p < .01$.

而就在動力學表現上，從表 2 中得知，當受試者使用低靠背時，其推進切線分力 ($p = .13$)、法線分力 ($p = .16$)、向內分力 ($p = .98$)及推進力距 ($p = .13$)

並無顯著性的差異，但推進總合力有減少的趨勢，卻未達統計上的顯著性的差異 ($p = .08$)，進一步經過以體重倍率標準化後分析，其結果亦符合上述的發現，在標準化之平均總合力 ($p = .10$)、標準化之平均切線分力 ($p = .14$)、標準化之平均法線分力 ($p = .24$)、標準化之平均向內分力 ($p = .66$) 皆呈現無顯著性的差異。然而在機械效益分析上，使用低靠背讓受試者顯著出現較高的推進效益 ($p = .02$)。

三、不同速度對於推進時運動學、動力學表現之主要效果 (main effect) 分析

從表 1 中得知，在運動學表現上，不論靠背的高低，當受試者進行快速推進活動時，需要以顯著較快的推進頻率 ($p < .01$)，較大的肩膀向後伸直的角度 ($p = .03$)、肩膀前彎後伸的活動度 ($p < .01$) 及較大的手部開始角度 ($p < .05$) 及手部整體的接觸角度 ($p = .03$)。但在肩膀外展的角度 ($p = .73$) 及整體外展內縮的角度 ($p = .08$) 卻不受推進速度的影響而改變。而從表 2 中得知，在動力學表現上，相較於在平面以慢速度的情況下，當受試者進行快速輪椅推進活動時，其推進總合力、切線分力、法線分力、推進力距皆有顯著性的差異 ($p < .01$)；進一步經過以體重倍率標準化後分析，施力結果的表現亦符合上述的發現。但在推進效益上卻沒有顯著性的差異 ($p = .26$)，皆維持 46%~45% 的效率。

表 2

使用不同靠背高度在不同速度下，進行輪椅動進活動時，動力學參數之平均值與標準差摘要表

動力學參數(單位)	靠背	0.9 m/s	1.3 m/s	高度之主 要效果 p -value	速度之主 要效果 p -value	交叉作用 p -value
平均總合力 (牛頓)	高	31.3 ± 7.8	36.4 ± 9.6	.08	<.01**	.41
	低	30.1 ± 6.5	34.2 ± 7.2			
平均切線分力 (牛頓)	高	18.9 ± 5.4	20.8 ± 6.3	.13	<.01**	.53
	低	18.4 ± 4.9	19.9 ± 5.4			
平均法線分力 (牛頓)	高	22.3 ± 7.1	26.2 ± 8.8	.16	<.01**	.49
	低	21.3 ± 5.6	24.5 ± 6.3			
平均向內分力 (牛頓)	高	3.4 ± 1.6	4.0 ± 2.0	.98	.01*	.92
	低	3.4 ± 2.2	4.0 ± 2.7			
標準化之平均總 合力(%體重)	高	5.5 ± 1.2	6.3 ± 1.1	.10	<.01**	.67
	低	5.2 ± 0.9	5.9 ± 1.0			
標準化之平均切 線分力(%體重)	高	3.3 ± 0.6	3.6 ± 0.7	.14	<.01**	.77
	低	3.2 ± 0.6	3.4 ± 0.7			
標準化之平均法 線分力(%體重)	高	3.9 ± 1.3	4.5 ± 1.2	.24	<.01**	.71
	低	3.7 ± 1.0	4.3 ± 1.0			
標準化之平均向 內分力(%體重)	高	0.6 ± 0.3	0.7 ± 0.3	.66	.02*	.99
	低	0.6 ± 0.3	0.7 ± 0.4			
平均推進力矩 (牛頓·公尺)	高	5.8 ± 1.6	6.4 ± 1.9	.13	<.01**	.53
	低	5.6 ± 1.5	6.1 ± 1.6			
平均推進功率 (瓦特)	高	17.4 ± 4.5	26.2 ± 7.8	.15	<.01**	.25
	低	17.0 ± 4.3	25.0 ± 6.9			
平均機械效益 (%)	高	0.4 ± 0.1	0.4 ± 0.1	.02*	.26	.72
	低	0.5 ± 0.2	0.5 ± 0.1			

註：* $p < .05$. ** $p < .01$.

討論

本研究的結果發現輪椅靠背的高度，確實會顯著影響推動時上肢運動學表現。當使用低靠背時，因其高度遠低於肩胛骨下角高，就本研究的參與者而言，低靠背高度平均低於肩胛骨下角高度達 17.3 ± 3.2 公分，所以在進行推動時，上臂有充足的自由活動度，不會受限於靠背結構高度，可以讓輪椅使用者上臂盡情的向後伸展，而出現較大的肩膀向後伸直的角度，及肩膀前彎後伸的活動度。同時，此上臂向後伸直的動作也帶動手部向後擺盪，可讓手部接觸輪圈位置落於輪圈後方，而造成較大的手部開始角度。此上肢姿勢便讓推進起始點，占有較大的優勢，允許使用者上肢以向後伸展的較大角度，開始進行向前推進的活動。而在向前推進時，上肢向前推動的動作並不會受靠背的高度所局限，且推動的形態類似，這一點可從本研究結果中的手部離開角度即印證出，手部離開輪圈位置並無顯著性的差異。因此，就整體推進時期 (push phase) 而言，當使用低靠背時，相較高靠背情況下，上肢推動時始於輪圈較後方的位置，而推動結束在輪圈前方相似的位置，此動作讓使用者有較大的上肢推動活動度，進而能有效的傳遞推進力量到輪圈上，避免無謂的施力浪費，提昇推進的機械效益，明顯地減少重覆性的推動頻率。Boninger、Impink、Cooper 與 Koontz 學者 (2004) 已指出高重覆性的輪椅推動頻率可能會誘發出正中神經的受損。因此，若能有效的減少推動頻率，應可避免未來因推動輪椅所引起的續發性損傷 (secondary injury)。

就動力學表現而言，本研究發現使用不同靠背高度會對輪椅推進時，所施於輪圈的推進切線分力、法線分力、推進力距與推進功率並無有顯著不同；然而在推進之總合力上，低靠背出現有較少需求的表現 ($p = .08$)，推進機械則出現顯著的提昇 ($p = .02$)。換言之，當受試者使用低靠背時，所施於輪圈上的向前推進施力 (切線分力, F_t)、推進力距及產生的功率與使用高靠背情況下並無差異。造成此現象的原因可能是實驗受測者在從事推動測驗時，推進速度的要求一致性所造成。根據先前研究輪椅推動的報告指出，不同的輪椅推動速度，會影響推進時運動學及動力學參數的改變 (Boninger et al.,

1997)，此現象亦被本研究結果之速度的主要效果所證實。因此，為了控制速度對實驗參數的影響，以便釐清靠背高度的影響性，本研究要求受測者需在輪椅運動平台上，隨著運動平台的寬跑帶轉動速度，進行並維持固定的輪椅推進速度，以控制輪椅推進速度的要求。所以，雖然靠背的高度會有所改變，但推動活動的速度是被要求維持在定速的狀態，因此，受測者所施於在輪圈上的向前推進施力、力距、及相對應所產生的功率，則應會維持無太大的差異性；否則，受測者將可能過快的去撞擊運動平台的前端，或過慢的跟不上平台跑帶轉動的速度。Kwarciaak、Tuner、Guo 與 Richter 學者 (2010) 研究指出使用輪椅運動平台，可讓研究者在有限實驗室的空間內，去創造出一個模擬平地上推動輪椅的情境，並且透過平台運動速度的可控制性，讓研究者可去掌握影響輪椅推動表現的變數並避免其交互作用的影響。本研究使用的輪椅運動平台，與 Kwarciaak 等學者所使用的儀器構造相似，亦確實達到同樣的功能，讓受測者在同樣的推進活動任務下，去比較靠背高度的影響性。雖然，在使用低靠背時，向前推進的施力並沒有顯著的不同，然而在法線分力及向內分力上卻有減少的趨勢但未達統計上的意義，因此會造成在總合力上出現較少的數值。根據機械效益的公式： $MEF = Ft^2/F_{total}^2$ ，其中切線分力 (F_t) 是造成輪椅向前推進之作用力，而總合力 (F_{total}) 則是施在輪圈上的各分力之總合，亦即切線分力、法線分力及向內分力之總合。倘若在公式分子的部份，向前推進的作用力並無差異，但在分母的部份，出現較少的總合力，這便意味著推進效益的增加；換句話說，使用低靠背能減少無謂的施力浪費，透過較大的上肢活動度，讓力量有效地施於輪圈上，而提昇了推進效益。

脊髓損傷的輪椅使用者因本身的不同損傷層級，軀幹控制能力會隨之有所差異。雖然本研究的結果顯示，使用低靠背能幫助輪椅使用者提昇推進的效益、有效地減低重覆性推動的頻率。但讀者需留意，本研究的受測者皆屬於低階層下肢癱瘓 (low level paraplegia) 的脊髓損傷者，這一族群的患者本身即具有良好的軀幹控制能力，不需要太多外力的支撐，所以高低靠背的差異性才能夠被呈現。倘若輪椅使用者為四肢癱瘓者 (tetraplegia) 或高階層下肢癱瘓 (high level paraplegia) 患者，因本身就缺乏足夠的軀幹控制能力，則需要較多的靠背支撐來協助及穩固軀幹，因此低靠背並不一定合適於這些族

群的使用者。此外，Rice、Koontz、Boninger 與 Cooper 學者 (2004) 針對脊髓損傷之軀幹穩定性在輪椅推進過程的研究中發現，在推進輪椅時，因軀幹會接受來自手部接觸輪圈的反作用力，所以，軀幹穩定性不足的脊髓損傷者，會因此而產生軀幹向後擺動的現象，此現象稱之為軀幹擺動運動，而此運動會間接削弱輪椅推動的效益。據此，倘若高階層脊髓損傷之輪椅使用者，採用低靠背來進行輪椅推進活動，則預期輪圈的反作用力，可能誘發軀幹擺動現象，這不但會造成輪椅使用者的軀幹不穩定，亦會降低推動的效益。所以，本研究的結果僅能應用於低階層下肢癱瘓的輪椅使用者，至於針對於缺乏軀幹控制能力的輪椅使用者，則需要小心去評估使用者軀幹所需支撐面的高度；此外，透過提供硬性材質的靠背也可協助這一類患者增加軀幹的穩定度，進而改善輪椅推動的效益。

雖然本研究的低靠背高度調整有依個體軀幹高度的不同，進行 50% 比例的調整，但高靠背的高度，基於尼龍座背墊尺寸受限，僅可摺疊縮短但無法伸展拉高，所以只能採用輪椅出廠時原有高度設定，這是本研究的主要限制。此設定可能讓部份軀幹較高的受測者，相較於軀幹較低者，出現高靠背高度的設定仍不夠高的現象，使得手部的擺動僅受到部份的限制，進而讓此類的受測者因而得到部份低靠背的正面效應，間接造成施力效益的提昇。本研究動力學的結果也可能因這設定上的受限，而導致在分析高靠背的總合施力及法線分力上，雖有過多的施力浪費趨勢但卻未達到統計上的意義。然而，本研究的目的是探討低靠背是否能排除對上肢的活動度限制，及推進效益的影響。就整體而言，低靠背的設定無論在進行快或慢速度的推進活動時，皆仍讓使用者出現較大的上肢活動度，及較佳的推進效益。惟從本研究的成果卻無法明確定義出理想的靠背高度，僅能提出：採用低於一半軀幹高的輪椅靠背對輪椅推動有正面的助益。建議未來研究可增加更細膩的分類，來探討不同百分比高度的靠背對於輪椅推進效果的影響。

本研究的結果顯示，使用低於一半軀幹高的輪椅靠背時，因移除了靠背對上肢活動的限制，明顯可增加上肢向後伸展的角度，增進了上肢推動時的活動度，進而能有效的傳遞推進力量到輪圈上，避免無謂的施力浪費，提昇推進的機械效益，並有效的減少重覆性的推動頻率。若就長期使用而言，亦

可避免因過高重覆性的輪椅推動，對上肢所誘發的續發性損傷。依據本研究
成果，在臨床上建議本身具有軀幹控制能力，且經常性自主推動輪椅的使用
者，如低階層下肢癱瘓脊髓損害患者，應選擇低靠背的輪椅作為主要的移動
輔具。此外，選購具有可調性靠背高度的輪椅，亦可幫助不同軀幹控制能力
的輪椅的使用者去改善輪椅推進的效益。

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The Effect of Backrest Height on Manual Wheelchair Propulsion Biomechanics

OCCUPATIONAL THERAPY

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Abstract

An optimal backrest height depended on the wheelchair user's ability of trunk control and mobility. High backrests could impede the range of motion of upper arm, thereby reducing the propulsion efficiency. Therefore, the purpose of this study was to evaluate the effects of different backrest heights by examining the changes on the upper extremity kinematics and kinetics at different wheelchair propulsion speeds. A repeated measurement design was used in this study. 30 manual wheelchair users with spinal cord injuries participated in this study. Participants were instructed to propel at two different speed conditions (0.9 m/s and 1.3 m/s) on a motor driven treadmill while using two different backrest heights respectively. Biomechanical data, such as kinematic and kinetic variables of the upper extremity, were collected during trials. A two-way repeated measure analysis of variance (ANOVA) was used to examine the main effect of different heights and speeds on these kinematic and kinetic variables. The results showed that when pushing with the low backrest height, which was set at 50% of trunk height, participants could swing their upper arms more backward ($p = .029$) with large range of motion ($p < .001$), increase forces application on the pushrim, and avoid unnecessary force waste, thereby increasing propulsion efficiency ($p = .015$) with less propulsion cadence ($p = .021$). In clinical application, it was suggested that active manual wheelchair users who have sufficient trunk control should use the low backrest to improve propulsion performance. It also could prevent secondary injuries of upper extremities related to high frequency of repetitive propulsion movement.

Keywords: Backrest, Shoulder, Biomechanics, Spinal cord injury

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應用學習鷹架融入教學對於 學生學習活動分析成效之探究

OCCUPATIONAL THERAPY

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摘要

職能治療經由活動分析提供有目的的活動，以協助個案促進職能。活動分析是職能治療師臨床工作中必備的核心技巧，因此，專業培育過程中，必須提供適度的學習協助以利學生專業能力的獲得。本文之目的為探究學習鷹架融入「活動分析」課程中，對於學生學習之效益。90 位職能治療學生隨機分為三組，A 組以學習工具鷹架、B 組以學習工具及教學者鷹架做介入，C 組為控制組。學習工具鷹架以自行設計、具引導性問句之「引導式活動分析表」作為介入，施測者間信度為 .82；表格經專家審查後，亦具內容效度。同時，以教師口語引導作為教學者鷹架。各組學生經 5 週的「活動分析」課程後，比較三組之學習成效差異。結果顯示三組學生以不同學習鷹架作輔助，學習成效有顯著差異。於事後比較，使用學習工具鷹架與教學者鷹架之組別，學習成效均優於控制組，並具有很大的效益與高度關連性($\omega^2=.45$)。深入分析發現，學習工具鷹架可提升學生在單元進行之程序性瞭解；教學者鷹架可提升學生對於職能治療專有名詞之概念瞭解，兩種鷹架的提供，同樣具有高度效果與強度關連($\omega^2=.19, \omega^2=.57$)。本文的結論為進行「活動分析」課程時，引導者可依據其教學之目的，適當提供學習鷹架作為輔助，以提升學生之專業學習成效。

關鍵詞：職能治療，鷹架，活動分析

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前言

職能 (occupation) 是每個人在日常生活中可以體驗到最平常與最熟悉的事物，是職能治療師考量個案需求的基礎，也是協助個案重新參與生活的治療媒介(Hersch, Lamport, & Coffey, 2005)。有職能缺損的個案若能參與合適的職能，則可以跨越因疾病而造成的能力缺損，發揮自己的潛能 (latent capacities)，進而獨立的執行對其而言是有價值的職能 (Radomski & Latham, 2008)。活動是職能的基礎，個案的職能表現反應了自身對於活動參與的需求、角色、興趣、經驗及價值 (Creek, 2008)。職能治療師在幫助個案的過程中，經由有效的環境評估、檢視職能之任務組成，以及進行活動分析 (activity analysis, AA) 與調適，以深入瞭解活動促進健康的本質，進而使用活動以治療個案 (Hersch et al., 2005)。治療師提供給個案之有目的的活動 (purposeful activity)，是以幫助個案參與日常職能，並獲得合適的發展為前提。經由個案為中心的模式進行臨床推理，考量個案的心理、生理以及社會的需求，使用多樣化的技術及媒材，形成最合適個案之介入方式 (Creek, 2008; Kielhofner, 2002)。

近年來，臨床醫療模式的改變，個案住院時間縮短，相對的也造成職能治療臨床操作模式及職能治療教育課程產生衝擊 (Griffin, 1993)。縮短的住院模式，使得職能治療師對於個案的處置流程，必須利用最短的時間做出正確的活動分析，以有效率的完成評估，進而瞭解個案參與活動的表現，以設計高品質的治療目標與計畫。因此，在職能治療學習階段，學生要能整合基本的醫學知識及職能治療專業知識，除此之外，正確且熟練的評估及活動分析的能力，亦是一項在職前培育階段的重要課題 (McCluskey, 2000)。因此，本文呈現一個教學方法的研究，於「活動分析」課程中，提供學生不同鷹架作為學習支持，以探討鷹架在學生學習成效上產生的影響。藉以提供學生在專業學習過程中，可以強化學習，並將學習轉移至臨床工作情境之方式。

一、活動分析

活動分析為第一次世界大戰時期，由工業管理學家 Gilbreth 與 Gilbreth 夫婦建議軍隊之職能治療師，利用工業上對於時序和動作研究 (time-and-motion) 的分析方法，分析戰爭中受傷之士兵殘存的作業功能。至今，當職能治療師需要瞭解活動特質時，仍以這樣的方式進行分析 (Radomski

& Latham, 2008)。在職能治療領域，活動分析可以分三個層級，第一層為探索活動本身所發生的情境、活動之需求，以及活動潛在之意義，是以活動本身為焦點之活動分析；第二層為聚焦於理論上之活動分析 (theory-focused activity analysis)，是以特殊的理論檢視活動之治療性特質；第三層為以職能為導向之活動分析 (occupation-based activity analysis)，強調個案在參與活動時所涉及之要素之分析 (Crepeau, Cohen, & Schell, 2003)。職能治療師在專業倫理考量下，應擅長站在對個案最有利之公平正義角度，思考個案活動的需求，使用活動分析以確定個案所執行的活動對其自身具有最大的效益，同時藉以思考個案之職能表現，依據分析的基礎瞭解活動的本質，經由活動調適介入治療發揮最大效益 (Pedretti & Early, 2001)。

「活動分析」課程是職能治療師培育階段的基礎，也是臨床工作中之核心技巧與合法工具 (Creek, 2008; Mosey, 1986)。職能治療學生藉由「活動分析」課程，學習由個案之需求、活動的面向、以及個案執行活動的方式瞭解活動的特質，將活動分析的能力作為學習各種治療性活動計畫與帶領之基礎，對於由課程學習轉換到健康照護系統的臨床工作，在個案活動需求的敏銳度，以及具備詳細規劃活動各面向之能力都有碩大的幫助 (Hersch et al., 2005; Doherty, Stagnitti, & Schoo, 2009)。Hodgetts 等人(2007)針對職能治療在學生與畢業生對專業滿意度的調查發現，學生對於進入職場有很大的焦慮，主要因為自覺臨床技能不足，認為需要多一些的臨床技能之教育課程。對學生來說，學習理論基礎固然重要，但具體實際應用理論與技術，以及參與治療相關事務是學生想要更積極學習的；職能治療畢業生也認為學過的技能和介入技巧都較侷限，而且學習過程中沒有足夠的練習，讓他們覺得理論與實務無法結合使用，以及無法發展出更多合適的活動提供給個案 (Dickerson & Kaplan, 1991; Hodgetts et al., 2007)。在臨床技能中，讓學生可以結合職能治療理論與瞭解臨床實務中活動的使用，最好的方式就是透過在「活動分析」課程的學習，一步一步的拆解活動，在此過程中學生可以體驗活動、分析活動需要的表現技巧，以及發現活動中所蘊含的治療性特質 (Hersch et al., 2005)。這樣的過程是與教師在課堂上提供機械式學習 (rote learning) 的方式所不同的。但在專業學習的初始，如果沒有輔以適當的引導方式，常會是在重複的摸索及錯誤中學習。甚至，即使學過這樣的臨床技能，但在未來工作上也會因為不夠精熟而捨棄不用 (Perlman, Weston, & Gisel, 2008)。

「活動分析」課程內容對於職能治療學生來說，是一項領域特定的知識 (domain-specific knowledge)，是學生在職能治療領域學習中，應獲得之智力技能 (intellectual skill)。而這項能力可幫助學生在職能治療學習過程，透過練習和實作體驗，協助其他知識的組織與技能的獲得 (張春興，民 96)。智力技能包含概念瞭解 (conceptual understanding) 的能力，也就是將職能治療專業知識，經由對個別概念的特質、原理與原則，進行分析和理解，而與其他概念關連轉化，成為如理論架構般之陳述性知識的過程。智力技能也包含程序性瞭解 (procedural understanding) 的能力，即是指利用概念去執行的知識，可稱為一種行為技能。一旦技能中的一組行動都能正確習得，且反覆練習之後，則所形成的程序性知識，即能快速表現為極度純熟的技能 (岳修平，民 87; Hallett, Nunes, & Bryant, 2010)。上述兩項能力並不好學，而對應到職能治療學生學習「活動分析」課程中，學生面對的挑戰來自兩大部分：第一部份是將職能治療專有名詞 (uniform terminology) 概念化，並與過去學習，以及現在正在進行的活動分析產生關連的概念瞭解過程；第二部分為對活動分析執行方式之程序性瞭解，也就是需要十分熟悉活動分析之一系列動作，並能知道如何執行 (know how)，且具備獨立、成功地執行活動分析之能力 (Hung, 2010a)。而學習過程中，概念的瞭解是進入程序性瞭解的前提，但程序性瞭解可支持整個活動分析的進行 (Hallett et al., 2010)，因此兩項能力需相輔相成，才可以提升活動分析之智力技能。

Perlman、Weston 與 Gisel (2005) 的研究發現，學生在學習「活動分析」課程以及活動分級的表現不如預期，無法以專業性的角度分析活動，也無法形成有目的的活動來提升個案的職能表現。學生在「活動分析」課程的學習上，影響其表現所涉及的面向包含：(一) 教師：學習上有引導者持續、即時的回饋引導，應該可以提升學生活動分析能力；(二) 學習材料：規劃出一份良好的活動分析指引，以及一套可以提升學生動機的活動表徵，將可提升學生能力；(三) 練習：一項技能的純熟是需要持續不斷練習以形成，以及(四) 成功的經驗：由學習中獲得的成功經驗之回饋，將可以提供學生滿足，讓學生勇於勝任活動分析的學習任務 (Perlman et al., 2005)。Perlman 等人(2008) 研究歷年來以電腦介面作為學習協助，融入活動分析課程之成效。發現經由電腦軟體確實可以提升學生活動分析的能力，但也發現軟體介面操作的困難，會讓電腦融入教學中，耗掉課程二倍的時間。此外，軟體介

面的選項式操作與臨床活動分析現況有落差，讓學生在進入臨床工作前需要重新熟悉臨床判斷，以及學生必須在學習初始，即面臨需在沒有引導者的情況下做問題解決之困境 (Perlman et al., 2008)。

以上的研究發現，成為本文對於「活動分析」課程教學設計的重要參考。提供合適的教學協助，作為對學生學習的鷹架，可以在學習過程中提供支持，不僅協助學生提升自覺缺乏的活動分析臨床技能、降低學習介面的適應時間，同時發展一套與臨床模式相近、友善的分析模式，可以讓學生降低學習的焦慮，使在課堂上學習的活動分析技巧，能轉移到臨床運用的活動分析模式上。

二、鷹架理論

「鷹架 (scaffolding)」一詞最早是由 Wood、Bruner 與 Ross (1976) 所提出，指的是專家 (expert) 在生手 (novice) 的學習過程中，提供學習者支持，使其完成自己無法獨力完成的任務。近年來鷹架的概念被廣泛解釋，而常以學習鷹架 (learning scaffoldings) 代表教師在學生學習過程中，所提供之支持特定學習所使用的教學策略 (Sharmaa & Hannafinb, 2007)。鷹架的概念是由 Bruner (1986) 連結 Vygostky 提出的近側發展區理論 (zone of proximal development, ZPD) 而來 (Stone, 1998a)。ZPD 之距離指的是學習者獨自進行問題解決的實際層次，以及經由較有經驗專家溝通互動或工具協助，所產生之較高認知層次兩者之間的差距 (Wertsch, 1991)。學習者若能透過有效之教學引導，就可以跨越學習落差 (learning gap)，減少摸索的時間，而獲得較高的學習成效，並且可以參與難度較高的學習活動 (McNeill, Lizotte, Krajcik, & Marx, 2006)。

教師所提供的學習鷹架，目的即為減少學生學習的 ZPD。因此，學習鷹架在學習協助上應有幾個特性：(一) 應在學生現存的瞭解能力下，鼓勵學生參與有意義的高層次心理過程 (psychological process)，漸進在學習活動中獲得內化 (internalization) 與獨立 (Puntambekar & Hübscher, 2005)；(二) 教師在使用鷹架過程中必須要持續的檢視學生的瞭解情形，以隨時提供最適切的，或者不同形式的支持 (Stone, 1998a)；(三) 多元而不同的學習鷹架所提供的學習支持將有利於學生學習 (Sharmaa & Hannafinb, 2007)；(四) 鷹架對於學習之支持是暫時性的，必須隨著時間逐漸的撤除 (fading)，使學生能

漸進式的擔負起學習的責任 (Puntambekar & Hübscher, 2005; Sharmaa & Hannafinb, 2007)。

綜合上述，提供學習協助給學習者，應就其現有的能力及學習困難處，提供合適的協助。職能治療學生在「活動分析」課程學習上之困難處，在於必須連結對專有名詞的概念學習與知識處理的程序瞭解於活動分析應用上。本文也據此，在教學中規劃合適的學習鷹架，以縮短學生學習上的 ZPD。

三、提供學習鷹架的方式

學習鷹架必須依據學生的現在的能力，提供適當的挑戰以促進學生自我學習，且必須是具有彈性的引導。教師在擔任引導者角色時，可以提供學生包含知覺、情感和認知的支持要素，這是給學生最好的鷹架方式 (Puntambekar & Hübscher, 2005)。但現今的職能治療教學中，幾乎是大班教學情境下，若每遇見一個學習困難點，都使用學生與教師一對一的學習引導鷹架，這是有困難的。但若轉換成其他方式來鷹架學生學習，也可獲得很好的效益 (簡錦鳳，民96)。一般說來，在學習的過程中，教師規劃之鷹架可以提供之支持內容包含：(一) 吸引學生的注意力、(二) 將任務結構化及簡單化、(三) 提供引導、(四) 標記學習任務之重要特徵、(五) 減少挫折，以及 (六) 提供任務解決方式之示範 (Hsu & Roth, 2009)。而組織鷹架時，可以使用的方式有 (簡錦鳳，民96; Quintana et al., 2004; Stone, 1998a, b)：(一) 課程鷹架 (curricular scaffolds)：教學者規劃了課程進行的方式，組織合適的教學材料提供給學習者，以逐步達成教學目標，即是提供給學習者一個最大的學習鷹架，此類鷹架包含：教師的課程設計、教材編排等 (Enfield, Smith, & Grueber, 2008)；(二) 教學者鷹架 (coaching scaffolds)：主要是以教學過程中的對話模式，來協助學習者，實現想要的學習方向。教學者在提供口語引導時不僅意圖引起教室內的互動，亦可引起學習者的主動反思，常見的教學者鷹架有：直接教學、討論、提問、提示、回饋等；(三) 同儕鷹架 (peer scaffolds)：使用學生間相互支援合作的方式，使學習過程中的焦慮情形降低、相互學習優點與校正缺點。此類鷹架包含同儕分享與合作討論等；(四) 學習工具鷹架 (learning instrumental scaffolds)：提供的鷹架可以協助學生有效的組織資訊、執行行動或是活動分析時以建構認知及學習，這些工具鷹架包含文字提示之工作單、電腦程式等 (Stone, 1998a; Wu & Krajcik, 2006; McNeill et al., 2006;

McNeill & Krajcik, 2009)。

到目前為止，本文已討論了活動分析在職能治療學生學習階段，及未來臨床工作上的重要性與困難處，並且瞭解在學習過程中提供適合的鷹架支持學生學習，可提高學生學習成效，而支持學習的鷹架可以有不同的來源 (Quintana, Meilan, & Krajcik, 2005)。本文試圖以ZPD為理論基礎，並依據學習鷹架可支持學生學習為設計研究之想法，依據學生初次學習「活動分析」課程之特性，以及課程規劃中需要學生實作之需求，以教學者鷹架以及文字形式之學習工具鷹架，協助學生因應學習。藉由探討不同鷹架模式對學生學習成效之影響，找出學生學習「活動分析」課程的過程中，教師可以提供之最合適的教學引導方式。更進一步的，分析學生在「活動分析」課程中，對於概念瞭解與程序性瞭解上之差異。

研究方法

一、研究對象

90位五專職能治療三年級學生參與本次「活動分析」課程，學生隨機由班級中抽出，並分為三組，每組30位同學。研究對象於參與「活動分析」課程前，已於心理疾病職能治療（一）課程中，瞭解心理疾病職能治療之哲學基礎、執行業務之流程與方式，以及治療介入之合法工具等。以三組學生於心理疾病職能治療（一）之學期學業成績，做基準點之比較，三組學生在學習起始點上沒有顯著差異 ($F(2,87) = .946, p = .32$)，意即三組學生在進行「活動分析」課程前，基準點是相同的。

二、實驗設計

本研究依據準實驗設計，將參與課程之學生隨機分為三組。A、B組學生為實驗組，提供鷹架做為學習支持，C組為對照組，在教學過程不提供額外的學習鷹架做為支持。三組實驗設計為：A組在「活動分析」課程中，均使用學習工具鷹架：「引導式活動分析表格」（以下簡稱「引導式表格」，請見附錄一）；B組在「活動分析」課程中，使用「引導式表格」作為學習工具鷹架，同時提供教學者鷹架：「教師口語引導」做為支持；C組在「活動分析」單元中，僅提供「一般活動分析表格」進行活動分析。

三、學習鷹架

本研究之「活動分析」課程，採用的學習鷹架包含學習工具鷹架與教學者鷹架，以下介紹鷹架之設計及內容：

(一) 本研究中提供「引導式表格」作為學習工具鷹架，當學生進行活動分析時，可以經由表格中之引導式問句而獲得書寫引導。「引導式表格」為研究者參考臨床常用之活動分析表--期望的表現 (expected performance) 部分進行規劃，並參考 Creek (2008), Haglund 與 Henriksson (1995)，及 Hersch 等人 (2005) 關於活動分析之概念與定義所形成。表格內容為：第一部份：活動之一般特質；第二部分：分析職能表現的領域；第三部分：活動表現需求，包含生理層面、認知層面、心理層面，以及人際互動；第四部分：表現的形式和情境，共 77 個細項。分析項目之數量與臨床上常用的「一般活動分析表格」相同，但是，「一般活動分析表格」只提供各部分與層面需要分析的項目，分析時由職能治療師依據對活動的瞭解，逐項做分析及描述，需做的描述內容並沒有一定的方式，完全由分析者決定。而研究者自行研發的「引導式表格」係針對每一個分析項目提供 2~3 句分析時的思考引導，使學生易於連結該分析項目所需求的專有名詞定義，以及該如何描述以連結整體活動分析內容。例如：生理層面之肌肉維持收縮的狀態 (Strength)，提供的思考引導語句為「參與動作的肌肉群，其收縮的類型為等張或等長為主？收縮的力量為何？(試以 MMT 當中等級描述)」。

表格製作完成後，敦請三位職能治療專家教師，針對 77 個分析項目之思考引導問句做審查。引導式表格內每項項目，具兩位以上之專家認同問句編寫，符合該項目之引導的，有 63 項 (82.9%)；而只有「1 位專家同意」(11 項) 及「3 位均不同意」(2 項)，共 13 項 (17.1%) 沒有通過審查，需要加以修改。此 13 項目沒有通過審查之原因，均是原先使用之引導式問句之描述，較無法傳達該項目內容。因此，經由專家建議加以修改後，使「引導式表格」內容較具有引導之功能，且具內容效度。在研究者做初次評分後，由另一位專家教師隨機選取 30 份做再次評分，兩位評分者間之一致性很高 ($r = .82$)，因此評分結果具有很高之可信度。

(二) 教學者鷹架：教學者鷹架為教師以一對一口語方式，在學生進行跑步與工藝美術團體之活動分析時給予引導。引導方式包含：1. 提供協助，

針對學生於活動分析程序不瞭解處，讓學生有機會發問，並給予回應。例如，當學生不瞭解生理層面「動作構成的成分及動用的肌肉」之分析方式時，教師會以口語提醒學生，「利用表格方式呈現該活動所涉及之主要動作，以及依序詳細條列，分析動作需動用的肌肉」；2.提供示範，對於學生不瞭解之名詞定義，教師利用開放式的問題，與學生先備知識做連結，或提供實例說明，以提升學生活動分析之品質。例如，當學生不瞭解「非人環境」之定義時，教師會先說明定義，並舉例一項活動中涉及之物理性因子，且回問：「想想看，還有哪些物理性因子，是個案在參與活動時需要的，且會影響其表現的？」。

一位良好的教學者，必須具備學科教學知識 (pedagogical content knowledge, PCK)。本研究中之「活動分析」單元教學者，為一位擔任職能治療教學 9 年的專家教師，熟知關於學生教學與引導方式之教學知識 (pedagogical knowledge)，同時亦對職能治療理論、活動分析之內容與程序具深入瞭解，也就是具備關於職能治療之學科知識 (content knowledge)。因此，該位教師具備職能治療相關之 PCK，足以勝任此單元之教學者鷹架提供者。

四、研究流程

本研究之「活動分析」教學單元進行時間為 2008 年 5 月至 6 月間，於「心理疾病職能治療實驗(二)」課程末 5 週進行。三組學生依據所提供的活動分析表格，在 2 至 2.5 個小時的時間內，以活動為焦點的分析個案進行活動的需求。研究流程分為三個階段(表 1)：第一、二階段為實驗進行前的準備活動，第三階段為正式實驗教學階段。

表 1

「活動分析」教學單元進行時間表及內容

研究 a 階段	週數	活動分析單元內容
一	第一週	活動分析表格各項內容定義：引入「職能治療專有名詞」
	第二週	以活動團體為例說明活動分析之方式
二	第三週	購物活動分析：各組學生熟悉活動分析表格 ^b
三	第四週	跑步團體活動分析：提供「學習工具鷹架」與「教學者」鷹架
	第五週	工藝美術活動分析：提供「學習工具鷹架」與「教學者」鷹架

註：^a第一階段：單元內容介紹、第二階段：熟悉研究工具、第三階段：實驗正式進行。

^bA、B組使用「引導式活動分析表格」；C組使用「一般活動分析表格」。

第一階段在教學前兩週（第一、二週），為讓學生瞭解概念，由教師引介活動分析單元之概念及分析示範，三組學生皆進行，且進行模式相同。

第二階段（第三週），因為學生從未參與過活動分析之學習，為使學生熟悉即將使用的學習工具鷹架及流程，提供購物活動作為範例。購物活動在臨床上的運用，是治療師為達到個案治療目標，使個案回復日常生活，常運用的任務技巧團體 (task skills groups) (Barris, Cordero, & Christiaansen, 1986)。此購物團體在重新調整內容後，僅強調個案生理層面及認知層面的方式，讓學生可以練習及熟悉活動分析表格的使用模式。

提供學生進行分析之活動團體，係由課程教師經設計後拍攝，並以簡報軟體 (power point)，將每個活動進行流程中之特徵圖片組織而成。進行活動分析時，活動團體以簡報軟體循環播放，讓學生可重複觀看而進行活動分析。三組學生皆以提供之活動分析表格（A、B組為引導式表格，C組為一般表格）進行練習，但由教師提供引導之教學者鷹架，在學生正式進行活動分析前，不提供給學生做額外的練習。

第三階段（第四、五週）為正式的實驗教學階段，三組學生皆參與教學活動，與進行活動分析。A、B組學生使用學習鷹架，進行活動分析。此階段活動分析單元包含之內容為：（一）跑步活動，為健康體適能活動 (physical fitness) 之一部份，因為體能團體本身特質，看起來會讓個案健康，尤其是跑步運動，是簡單且能與環境互動的體能性活動，是很常在臨床上被建議使用的活動 (Barris et al., 1986; Creek, 2008)。提供給學生進行活動分析之跑步團體，為雙人一起進行之活動，內容強調個案之生理、心理以及人際互動層面。（二）工藝與美術是 Kilhofner (1983)認為在職能治療活動團體中最有價值，且能提供個案參與經驗、獨立、自我價值情境之活動，也是在臨床工作中經常提供給個案的活動 (Dickerson & Kaplan, 1991)。本次提供給學生進行活動分析之工藝美術團體，內容為個案在工作室中為皮雕作品上色，強調個案的生理、認知以及心理層面之功能。

五、資料收集與分析

本研究以嵌入式評量 (embedded assessment) 模式進行，意即研究工具之執行與學生學習成效之評量是一起進行而完成。三組學生於各次活動分析表

格之成績，視為學生於該鷹架學習過程中所獲得之學業成效 (academic achievement)。活動分析評分方式，為以對表格中各細項之定義瞭解 (1 分) 作為對活動分析的「概念瞭解」；以及執行活動分析時，內容描述的完整及銜接順暢性 (1 分) 作為學生對於執行活動分析之「程序性的瞭解」。每項得分最高為 2 分，最低為 0 分，單次活動分析總分為 154 分。評分各項目之「概念瞭解」的原因，是欲分析學生在「活動分析」單元中，對於專有名詞的瞭解程度與教學者鷹架介入之關係；評分「程序性的瞭解」是想分析學生在「活動分析」單元中，針對活動描述該項目時，使用「引導式表格」及「一般表格」在書寫內容上以及整體執行的統整表現之差異。

本文之資料分析，首先，比較整體學生進行活動分析時，使用不同學習鷹架之成效。進行三組比較時，以三組進行「跑步團體」及「工藝美術」兩次活動分析之平均成績做比較，以分析學生在鷹架融入教學後，學習成效所產生之改變；接著，再深入探討學生在鷹架融入教學後，對於「概念了解」以及「程序性了解」部分的差異。以上二部分以單因子變異量分析 (ANOVA) 進行檢驗。此外，本文採用效果量 (effect size, ω^2) 來描述學習鷹架引入活動分析課程之有效程度， ω^2 為 .010, .059 及 .138 分別代表低、中、高效果 (Howell, 2007)。由 ω^2 值也可以瞭解不同學習鷹架之使用與學生學習成效間之關連。在關連強度指數高低判斷方面，解釋變異量在 6% 以下者，顯示變項間關係微弱；解釋變異量在 6%~16% 者，顯示變項間中度關係；解釋變異量在 16% 以上者，顯示變項之間具強度關係 (吳明隆，民 88)。

結果

一、使用學習鷹架之成效

使用不同學習鷹架之 A、B 組，以及控制組於進行跑步團體、工藝美術兩個團體活動分析時，其平均成績如表 2。因為三組在進入「活動分析」單元前之學業成績沒有顯著差異，於是再進行單一變項變異數分析比較，其結果如表 2 所示。三組學生在「活動分析」單元中，學習成效上呈現顯著差異 ($F(2,87) = 38.95, p < .001$)。經用 Scheffe 法做後續分析，發現 A 組 ($M = 99.5, SD = 13.2$)、B 組 ($M = 101.6, SD = 13.0$) 學習成效沒有差異，但是均優於 C 組 ($M = 72.9, SD = 15.8$)。意即 A、B 組學生在「活動分析」單元中，使用學習鷹架作為輔助，學生的學習成效優於沒有使用鷹架之 C 組。

以各組兩次活動分析之平均成績進行比較，以瞭解學習鷹架之效益。結果發現具有大幅度的效果量 ($\omega^2 = .45$ ，大於 .138)，也就是使用不同學習鷹架之 A、B 組，以及控制組，在平均分數上有大幅差異。在關連強度指數上，鷹架融入教學，對於三組的學習成效具有約 45% 的影響程度，因此顯示，以學習鷹架介入在「活動分析」單元中，與學生的所獲致的學習成效之間具強度關係。

表 2
三組之「平均成績」，以及於「概念瞭解」及「程序性瞭解」之平均分數及變異數分析摘要表

變項	A組(n=30)			B組(n=30)			C組(n=30)			ANOVA	
	M	95% CI		M	95% CI		M	95% CI		F(2, 87)	ω^2
	(SD)	下界	上界	(SD)	下界	上界	(SD)	下界	上界		
平均	99.5	94.4	104.6	101.6	96.5	106.7	72.9	67.8	78.0	39.0***	.45
成績	(13.2)			(12.9)			(15.8)				
概念	38.8	36.7	40.9	44.6	41.5	47.9	34.0	30.5	37.5	13.4***	.19
瞭解	(5.6)			(8.6)			(9.4)				
程序	60.7	60.0	64.4	56.9	54.3	59.5	38.95	36.3	41.6	60.9***	.57
瞭解	(10.0)			(7.0)			(7.1)				

註：A組使用學習工具鷹架，B組使用學習工具與教學者鷹架，C組為控制組。

ω^2 = 效果量。

*** $p < .001$.

二、鷹架對於概念瞭解與程序性瞭解之影響

「活動分析」單元之學習是一項心智能力獲得的過程，涉及對於知識的概念瞭解與知識之程序性瞭解 (Hallett et al., 2010)。因此，為了更進一步瞭解學生在「活動分析」單元的成就表現，將成績分為「概念瞭解」及「程序性瞭解」兩部分成績，則可深入探討當學生進行兩次活動分析時，鷹架對於學生活動分析表現造成的影響。

三組學生在「概念瞭解」之平均分數如表 2，B 組在概念瞭解上之表現較其他兩組佳。表 2 為以變異數分析比較三組學生之「概念瞭解」與「程序性瞭解」之得分。在概念瞭解上，三組學生在跑步團體及工藝美術團體之學

業表現呈現顯著差異 ($F(2,87) = 13.38, p < .0001$)。以 Scheffe 法進行後續分析，發現 B 組 ($M = 44.7, SD = 8.6$) 學習成效優於 A 組 ($M = 38.8, SD = 5.6$) 與 C 組 ($M = 34.0, SD = 9.4$)，但 A、C 組間沒有差異。同時，以學習工具鷹架作為活動分析之學習輔助，學生在「概念瞭解」上可以獲得高度效果及強度關連 ($\omega^2 = .19$ ，大於 .138)。探究 B 組學生較 A、C 組在「概念瞭解」上表現優異，在於 B 組學生多了教學者鷹架，使得學生可以經由教師口語引導協助釐清及連結對於專有名詞的定義。而且鷹架融入教學，對於三組學生在「概念瞭解」的學習成效具有約 19 % 的影響程度，因此可以推論，以學習者鷹架介入「活動分析」單元中，與學生所獲致的「概念瞭解」具強度關係。

學生在「活動分析」教學單元中，對於「程序性瞭解」之平均分數摘要，如表 2 所示。更進一步以變異數分析比較學生之「程序性瞭解」之得分，如表 2 所示。結果發現，三組學生在「程序性瞭解」的表現上，呈現顯著差異 ($F(2,87) = 60.85, p < .0001$)。分析使用不同學習鷹架對於活動分析「程序性瞭解」之影響，發現可以達到高度效果值，且在關連強度上具有強度相關 ($\omega^2 = .57$ ，大於 .138)。再以 Scheffe 法進行後續分析，發現 A 組 ($M = 60.7, SD = 10.0$)，B 組 ($M = 56.9, SD = 7.0$) 間沒有顯著差異，但均優於 C 組 ($M = 39.0, SD = 7.1$)。A、B 組與 C 組的差異即是在於學習工具鷹架：引導式活動分析表格之介入。因此可以推論，使用學習工具鷹架於「活動分析」教學單元中作為中介因子，對於學生的「程序性瞭解」有高度的效益，且具有 57% 的影響程度，兩者的關係是強度程度的影響。

討論

「活動分析」既是重要的臨床能力，也是職能治療專業知識的核心，但在職能治療學生專業學習的過程中，過去研究發現學生在「活動分析」單元中，即使已依據臨床常用的活動分析表格進行分析，但學生的執行表現仍無法達到預期水準，無法以專業性的角度分析活動，以及無法形成有目的的活動來提升個案的職能表現 (Perlman et al., 2005; Hung, 2010b)。

本研究以學習工具鷹架（引導式活動分析表格）以及教學者鷹架（教師口頭引導）兩項學習鷹架作教學介入，發現學生經由鷹架支持學習，可以得到更佳的學習成效，但相較於使用電腦介面進行「活動分析」單元，本文使用引導式活動分析表格及教師口語引導，較具有時間效益。此外，以書面進

行活動分析的方式與臨床工作上進行活動分析的模式相同，學生在相似的情境下，學習轉移較近，易獲得較佳學習成效 (Gagné, 1985)。以下就幾項議題進行討論：

一、學習工具鷹架協助程序性瞭解的提升

由使用引導式分析表格的 A, B 組與使用一般表格的 C 組相較，引導式分析表格之引導式問題可以讓學生較深入地達到程序性的瞭解。學生可以具體、有整體性方向的表達想法。同樣的，書寫的方式可以讓學生完整的陳述想法，仔細的描述活動情境於個案涉入時需要注意的事項及需求的能力，讓教師清楚看見學生在限定及良好規劃之情境下，對於活動分析所表徵出之心智模式 (Johnson-Laird, 1989)。經由學生書寫的描述也可以知道學生學習困難所在，可以提供適當的學習協助。此外，學生使用引導式活動分析表格進行活動分析，所獲得之學習成效，較使用僅有分析項目，而沒有引導語句之一般活動分析表格表現佳，其最主要的因素為學生在使用引導式活動分析表格時，應是在瞭解各項分析項目的詳細定義下進行，若學生在進行活動分析時仍不明白專有名詞之定義時，也可以經由引導式活動分析表內的引導問句，獲得對專有名詞定義的瞭解之導引，不至於在誤解或不瞭解分析項目情況下而無法作答。在學習中加入引導鷹架，對學生而言，最大的優點為降低學生對活動分析這項學習任務之恐懼，同時可以激發學生學習的動力以及引導學習的方向，進而因為不同之學習鷹架提供的引導作用，使學生在活動分析時，可以系統性的方式為活動的特質提供具支持性、較完整的分析與解釋 (McNeill et al., 2006; McNeill & Krajcik, 2009)。

二、教學者鷹架協助概念瞭解的提升

教師口頭引導後，學生在概念瞭解上具顯著差異。A、B 組學生在兩次活動分析之平均成績相當，但因為 B 組在教學者鷹架協助下，概念瞭解提升，使得整體成績與 A 組相較雖未達顯著差異，但還是略高。此部分結果與 Hallett 等人 (2010) 之研究中所提及的相同，也就是學生在學習過程中，若有概念性瞭解之能力來支持更高階之程序性瞭解之學習，將能有效的提升整體學習成效。此外，在強調臨床能力之學習與獲得的課程中，單由一般生硬的課堂講述教導，是不容易達到讓學生獲得學習之目的，優良的引導者可以在口語

引導中準備許多啟發學生思考的問題，經由提出問題要求學生做邏輯思考與連結過去的學習經驗 (Savin-Baden & Howell, 2004)。此即為教學者鷹架中，教師經由口語，提供領域專門知識的思考引導，而提升學生在「活動分析」單元之概念瞭解部分學習成效的方式 (McNeill & Krajcik, 2009)。而教師口語引導的介入可以依照學生的條件能力、接受程度及學習風格調整口語引導方式 (斷論式、建議式、合作式以及促進式) (Leung, Lue, & Lee, 2003)。同時，在學生概念瞭解教學上的建議，認為一個新概念在教授時，相關的概念與過去的學習經驗，應該協助學生進行統整與連結，這樣會讓學生的學習更穩固 (Berthold & Renkl, 2009)。這是教學者鷹架之存在可以加速學習的重要性，同時也無法以其他教學輔助模式取代的部分。

三、鷹架的交互作用

鷹架使用於教學中可以影響學生的學習，但使用多重鷹架 (multiple scaffoldings) 於教室這個複雜的學習系統中時，除了需要瞭解個別鷹架可以達到的支持形式，仍必須經由檢測，瞭解在哪些情況下，鷹架的交互作用對於學習支持之影響，是為分散性的 (differentiated)、或協同性的 (synergistic)，或重複的 (redundant) (McNeill & Krajcik, 2009; Tabak, 2004)。

本研究中 B 組同時有兩項鷹架支持學生學習，雖然各自滿足學生不同學習需求，但於程序性瞭解分析中發現，B 組即使多提供一項教學者鷹架，但 A、B 組學習成就相當。此可說明，兩項鷹架對於 B 組學生程序性瞭解上之學習需求，提供了重複的鷹架 (redundant scaffoldings) (Tabak, 2004)。推論 B 組學生組內學習風格具差異，學生僅由兩項鷹架中之一項獲得程序性瞭解的協助，兩項鷹架各自支持了不同學生的相同需求，鷹架對於學習成效的作用是獨立而不具累積性，所以學習結果僅與 A 組相當。另一方面，B 組在兩項鷹架的支持下，於概念瞭解上顯著優於 A、C 組，顯示兩項鷹架對於概念瞭解來說，是一種協同性鷹架 (synergistic scaffolding)，交互作用下，對於概念瞭解有累積加成的效果 (Tabak, 2004)。

四、適時的撤除鷹架以利獨立學習成長

學習鷹架是一種彈性引導的過程，隨著學生能力的提升，引導應隨學生能力而修正，在適當的時機撤除鷹架 (fading scaffolds) 才可讓學生逐步的獨

立學習成長 (McNeill et al., 2006)。本文中所使用的兩種學習鷹架，在之前的研究中曾提出，口語引導的學習鷹架在學習的初期提供，可以提升學生的學習的效益，而隨著學生能力的提升，應可以逐步撤除，讓學生獨立自我學習成長；在學生的學習環境中，可接觸到的學習引導繁多，如同引導式分析表格的書面鷹架，與其他學習支持並不衝突，引導式表格可成為獨立學習時的書寫提示，可誘發學生在獨立活動分析時進行的精確性 (McNeill et al., 2006; Puntambekar & Hübscher, 2005)。

總結而言，一次完整的活動分析，涉及數種職能治療專業能力，包含職能治療知識基礎（例如：專業倫理、對職能的認知以及對於職能治療專業哲學的認識等），還包含應用於實際職能治療業務執行上的臨床技能（例如：對於個案需求、活動本質的瞭解，以及活動調適的方式等）。在課堂上使用合適的學習鷹架誘發、提升、引導學生做知識的整合與應用，能讓學生的理論學習與臨床接軌，這正是職能治療教育的目的，讓學生具備在職能治療課堂外，能獨立進行職能治療臨床技能的能力。

本文發現使用引導式活動分析表格，以及教師口頭引導學習鷹架可以提升學生的學習成效，教師的口頭引導可以依照學生的條件能力作調整，適性化的引導讓學生學習加速提升概念性的瞭解；而書面引導的學習鷹架是學生熟悉的，在操作使用上需要較短的熟悉時間，且讓學生能將學習成效較快轉移到臨床工作上，同時可以提升學生程序性的瞭解。建議在職能治療學生學習活動分析的過程，教師可考量不同教學上的目的，及學生的學習需求，使用引導式活動分析表格，以及教師口語指導做為學習鷹架，多次的使用練習，可以讓學生清楚職能治療活動分析的概念，讓學生對於活動特質的描述更精確與清晰，對於學生的學習成長具有良好的成效。最後，關於多重學習鷹架間，交互作用對於支持學習的差異，則可在往後的研究中持續探討。

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附錄一

引導式活動分析表格（僅呈現第三部分之生理與認知層面）

活動分析：期望的表現	
編號	項目內容
第三部份:活動的表現要求(Performance requirements)	
(一)生理層面(Physical)	
1	姿勢及雙側/單側操作: -主要的活動操作姿勢為何（站姿、坐姿……）？ -需要（或可能是）單側或雙側操作？ -需要身體的穩定度嗎？
2	主要動作與參與的肌肉： -主要的動作為？（可以列表） 主要動作 動作角度範圍 動用的肌肉 (1) (2)
3	阻力方向: -活動中哪些步驟會出現阻力？ -阻力方向為何？
4	移動性: -參與活動者是否需具可移動性？ -哪些步驟會需要移動？ -參與活動之移動空間大約多大？ -參與者可以如何移動（走動、伸手取物、彎曲身體）？
5	平衡: -活動中需要平衡感以維持動作進行嗎？ -哪些步驟會需要移動？
6	柔軟度: -活動中需要柔軟度嗎？ -在執行活動的哪一個部分需要？
7	重複性動作: -哪些步驟會出現重複性動作，該重複性動作的頻率為何（次/分鐘）？
8	韻律性: -活動中之操作具韻律性操作以使活動流暢嗎？在活動中之哪一個部分需要？

9	肌肉維持收縮的狀態: -參與動作的肌肉群，其收縮的類型為等張或等長為主？收縮的力量為何？(試以 MMT 當中等級描述)
10	體能耐勞: -活動中需要耐力以持續工作嗎？哪一個動作？ -耐力需要的程度為何？需持續多久時間？
11	操作的速度: -哪些步驟較需要速度？自己可以掌控或調整操作的速度嗎？
12	活動分級: -活動可以分級嗎？ -可用哪些要素分級？分級的方式為何？
13	活動調適: -活動可以調適嗎？ -可如何調適？"試說明活動本身如何調整以適合參與者進行或加入的輔助器材名稱"
14	精細動作: -活動中有精細動作參與嗎？在哪些地方需要精細動作？ -參與的精細動作的類型為何？
15	粗動作: -活動中有粗動作參與嗎？在哪些地方需要粗動作？ -參與的粗動作的類型為何？
16	感覺(視覺/聽覺/味覺/嗅覺/觸覺(溫度、材料質地、輕重)): -活動中涉及感覺嗎？ -在哪些部分？有哪些感覺涉入？ -所接收的感覺強度與頻率為何？
(二) 認知層面(Cognition)	
1	注意力: -活動中需要注意力嗎？ -在執行活動的哪些部分需要注意力？ -需要何類型注意力(選擇性/持續性/分散性)？需要維持時間為多少？
2	問題解決能力: -活動中需要具備問題解決能力嗎？ -在活動中哪些部分需要問題解決能力？
3	辨識區別能力: -活動中需要具備辨識區別能力嗎？ -在活動中哪些部分需要辨識區別能力？

4	因果性: -活動中涉及因果性嗎? -涉及何類型的因果性? (直線因果/網絡因果)
5	邏輯性思考: -活動中需要具備邏輯性思考嗎? -在活動中哪些部分需要邏輯性思考?
6	類化: -需要將活動結果類化嗎? -活動中哪些成果可以類化?
7	教導方式: -參與活動者需要被引導嗎? -若需要,教導的形式為何(指令式/促進式/放任式)?
8	閱讀能力: -活動中需要閱讀能力嗎? -在活動中哪些部分需要閱讀能力?
9	語言使用: -活動中需要使用語言嗎? -在哪些部分需要使用語言?使用的類型為何(口語/肢體語言)?
10	符號與象徵的解析: -活動中涉及符號及象徵性嗎? -活動者需要瞭解符號及象徵性的使用嗎? -有哪些符號及象徵性涉入? -治療者會協助解析嗎?
11	數量: -活動是否需要認識數字或具備計算/測量的能力? -在活動中哪些部分需要使用數量?
12	抽象思考: -活動中需要使用抽象思考嗎? -在活動中哪些部分需要使用抽象思考?
13	感覺統合能力: -活動涉及感覺統合能力嗎? -需要統合的感覺包含哪些? -哪些部分/動作需要感覺統合以利執行?
14	動作計劃能力: -活動中需要使用動作計劃能力嗎? -在活動中哪些部分需要使用動作計劃能力?

15	<p>兩側整合能力:</p> <p>-活動中需要使用兩側整合能力嗎?</p> <p>-在活動中哪些部分需要使用兩側整合能力?</p>
16	<p>身體形象:</p> <p>-活動中需要使用身體形象嗎?</p> <p>-在活動中哪些部分需要使用身體形象之能力?</p>
17	<p>空間定向感:</p> <p>-活動中涉及空間定向感嗎?</p> <p>-需要的空間定向感為何?</p>
18	<p>對時間的感知:</p> <p>-活動需要具備對時間的概念嗎?</p> <p>-需要的時間的感知為何?</p>
19	<p>記憶:</p> <p>-活動中涉及記憶嗎?</p> <p>-需要的記憶為哪一類型 (短/中/長期記憶, 情境/語意)?</p>
20	<p>目標的設定(Goal setting):</p> <p>-活動需要訂定目標嗎?</p> <p>-需要訂定何種目標?(短/中/長期目標)</p>
21	<p>知識的範圍:</p> <p>-活動中涉及的知識範圍為何? (一般知識? 特定知識?)</p>

Intergrating Scaffold Strategies into Activity Analysis to Enhance Students' Learning Achievement

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Abstract

Activity analysis is a vital skill in the clinical environment, through which occupational therapists provide purposeful activities to assist clients in maintaining occupations. It is recommended that learning support should be provided for students to acquire the skills in activity analysis. This article reports the effectiveness of using learning scaffoldings in the teaching of activity analysis to enhance student's learning achievement. Ninety students were recruited and randomized equally into three groups. Written scaffold was used in group A, while both coaching and written scaffolds were used in group B. Group C served as the control group. A self-designed worksheet with directive sentences that provides learning guidance for activity analysis was used as a written scaffold. The worksheet was reviewed and modified based on expert opinions to ensure its content validity. The interrater reliability was 0.82 (Cronbach's α). Coaching was provided in the form of teachers' oral instructions during the class of activity analysis. Activity analysis unit was conducted for five weeks. Results showed that there were significant differences among three groups, indicating that written scaffold and coaching can promote students' learning with high effect size ($\omega^2 = .45$). Written scaffold facilitated students' procedural knowledge ($\omega^2 = .57$), while coaching had a significant effect on students' understanding of uniform terminology for occupational therapy ($\omega^2 = .19$). These results suggest that teachers can use different instructional scaffolding techniques to meet diverse student needs.

Keywords : Occupational therapy, Scaffold, Activity analysis

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投稿須知

- 一、 『職能治療學會雜誌』為台灣職能治療學會所發行一年兩期的專業學術期刊。本雜誌設有嚴謹的同儕審查制度，凡與職能治療有關之學術論述，且未曾發表於其他刊物，皆為本雜誌刊載之對象。本雜誌亦收錄由台灣職能治療學會主辦的學術研討會所發表的論文摘要以及學會各委員會執行學會或政府機構委辦之研究計畫結案報告。
- 二、 來稿以中文或英文格式撰寫均可。投稿類型包括原著(original articles)、個案報告(case reports)、專題(special reports)、文獻評論(review articles)、簡報(brief reports)與致編者函(letters to the editor)。
- 三、 **原著**：係指實證性研究論述。中文稿件字數(含參考文獻與圖表)以不超過 15,000 字為原則。英文稿件字數以不超過 5,000 字(不含參考文獻與圖表)為原則。
個案報告：中文稿件字數(含參考文獻與圖表)以不超過 6,000 字為原則。英文稿件字數以不超過 2,000 字(不含參考文獻與圖表)為原則。
專題：職能治療領域值得深入探討的特別邀請專題。中文稿件字數(含參考文獻與圖表)以不超過 15,000 字為原則。英文稿件字數以不超過 5,000 字(不含參考文獻與圖表)為原則。
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- 四、 惠稿請附上「申請投稿聲明書」(自行選擇由通訊作者代表簽名或全體作者簽名)，並將稿件以電子郵件方式寄至 cysu@cc.kmu.edu.tw；信件主旨請註明「職能治療學會雜誌投稿」。請依本刊撰稿體例投稿，**格式不符與字數超過者將逕予退回修正。**

五、 審稿程序

1. 預審：主編依據是否符合本刊之性質以及文章的嚴謹程度決定是否送初審。
2. 初審：稿件將聘請兩名文章所屬領域的專家學者進行雙向匿名審查。凡審稿者建議「修正後再送審查」之文稿，作者需將修改後之稿件(以紅色標示修改處)，連同「審查意見回應表」以電郵方式寄回本刊交由原審查者進行複審。初審結果將於收到稿件四週內完成並通知作者。
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4. 若需延期交稿者，需以書面通知本刊並說明原因。未能於規定期限內修改寄回者將視同撤稿。

六、 被接受的稿件由執行編輯小組負責一校，作者收到校正稿後需於收件日起三日內完成二校，再以電郵方式寄回。

七、 在本雜誌刊登之著作，其著作權屬於本會，除商得本會書面同意外，不得轉載於其他雜誌或媒體。

八、 經刊登之論文，本雜誌將贈送每位作者當期刊一本及論文之 PDF 電子檔，如需抽印本可自費印刷。

九、 中英文稿件原則：

1. 稿件格式：採用《美國心理協會出版手冊》第六版 (Publication Manual of the American Psychological Association, 6th ed., 2009) 格式。中英文部份略作修改，未及規範之處，以該手冊第六版為依據。
 - (1) 稿件應隔行打字於 A4 紙上，每頁上、下、左、右至少留白 2.54 公分。
 - (2) 字型：中文請統一用**標楷體**；英文請統一用 **Times New Roman**。字體大小請採 12 級字，每頁列有重新編碼之行號，以利排版及審稿。
 - (3) 行距：統一為**兩倍行高**。
2. 作者如超過六人，請註明個別作者在文章的貢獻部分。
2. 稿件內容架構：封面頁、中英文摘要、本文、誌謝、參考文獻、表格與圖。
3. 稿件應按下列順序分頁書寫，並請編頁碼於稿紙右上方，整理後提出。

封面頁：含作者姓名、執行該研究時服務單位，通訊者姓名、地址、電話及電子信箱（上半頁列中文資料，下半頁列英文資料，如為英文

稿件則相反)。著者屬不同機構或單位，其中文書寫形式如下列：

羅鈞令¹ 楊國德^{2,*}

臺灣大學醫學院職能治療學系¹ 中山醫學大學職能治療學系²

英文書寫型式如下例：

Jin-Ling Lo^a, Kuo-Te Yang^{b,*}

^aSchool of Occupational Therapy, College of Medicine, National Taiwan University, Taiwan

^bSchool of Occupational Therapy, Chung Shan Medical University, Taiwan

第一頁：中英文題目（英文題目中，除了小於4個字母的連接詞、冠詞和介系詞外之第一個字母請大寫）及中文20個字（或英文40個字母）以內的逐頁標題（running title）。

第二頁：中文摘要不超過五百字及至多5個中文關鍵詞。各關鍵詞之間以「，」區隔，句末不加「。」。請在頁末註明字數。

第三頁：英文摘要不超過250字及至多5個英文關鍵詞。請在頁末註明字數。

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本文：稿件應包括前言 (Introduction)、研究方法 (Materials and methods)、結果 (Results)與討論 (Discussion)。請在討論部分的末頁註明字數。中文稿件的第一階標題請使用16pt標楷體，粗體，置中；第一階標題編碼請使用國字壹、貳、參等，如**壹、前言**。第一及第二階標題與前段內文間均請空一行，第三階標題則不需空行。第二階標題請使用14pt標楷體，粗體，靠左對齊。第二階標題編碼請使用國字一、二、三等。第三階標題請使用12pt標楷體，粗體，靠左對齊。第三階標題編碼請使用有括弧的國字(一)、(二)、(三)等。英文稿件的第一階標題請使用16pt Times New Roman，粗體靠左對齊。第一階標題編碼請使用1, 2, 3等，如**1. Introduction**。第一及第二階標題與前段內文間均請空一行，第三階標題則不需空行。第二階標題請使用14pt Times New Roman，斜體靠左對齊。第二階標題編碼請使用1.1., 2.1., 3.1. 等。第三階標題編碼請使用12pt Times New Roman，斜體靠左對齊。第三階標題編碼請使用1.1.1., 2.1.1., 3.1.1. 等。

4. 統計符號請以斜體字標示，如：*t*檢定。度量衡單位採用國際單位系統符號。
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6. 本文引證格式：中文文獻作者為一人時，註明為姓名(民年代)或(姓

名，民年代)。當所引證文獻的作者為兩人時，兩人之姓名每次引證均需全部列出，中間以「與」字連接(見例一)；若為圓括弧中引證則以頓號(、)來連接(見例二)。若作者為三至五人，第一次引證時所有作者姓名須悉數列上，嗣後再引證時則只列第一作者姓名，後加「等」字代替其他作者。若作者為六人以上(含六人)時，則第一次和後續引證都只需列出第一作者，其後以「等」字表示。英文寫法請參見例四。在文末所附之參考書目中亦僅列出前六位作者。外文文獻格式請依據美國心理協會出版手冊第六版。

範例：◎ 例一：張彧與李文淑(民 83)提到……

◎ 例二：教育局支持在數個國小進行感覺統合療效研究計畫(羅鈞令、姚開屏，民 75)

◎ 例三：美國心理協會(1994, 1997)規定論文寫作……

註：閱讀的是中譯本，1994 是原著出刊年，1997 是譯本之出版年。

◎ 例四：Kosslyn et al. (1992)… 或 (Kosslyn et al., 1992)

註：當第二次以上引用三至五位作者文獻，或該文獻作者為六人以上。

7. 參考文獻：文獻應以文內實際提及之原始文獻者為限。中文文獻列於前，依姓氏筆劃遞增排列，筆劃相同依姓名第二字筆劃，以此類推；外文文獻列於後，依姓氏字母順序排列。外文請依美國心理協會出版手冊第六版格式繕寫，中文請參考以下範例。

◎ 期刊— 作者姓名(年份)。篇名。**期刊全稱**，**期別**，頁碼。

◎ 書籍— 章節作者姓名(年份)。篇名。編者姓名，**書名**(第 X 版，頁 XXX-XXX)。出版地：出版社。

◎ 其他刊物、電子媒體等，請參考手冊。

學會特刊的論文：

李建賢(民 73)。對於我國緊急醫療系統的省思與建旨。**急救加護醫學會特刊**，5，7-9。

學會會報的論文摘要：

張彧、李文淑(民 83)。台灣生理疾患職能治療從業人員媒介使用之探討。**中華民國職能治療學會第十四次學術研討會會報**，10。

單行本：

陳宗瀛、姜必寧(1993)。臨床心電圖學，頁 1-26。台北：華榮。

Mitchell, T. R., & Larson, J. R. Jr. (1987). *People in organizations: An introduction to organizational behavior* (3rd ed.). New York, NY: McGraw-Hill.

編著書籍的一章：

陳楷模(民 65)。腹部急症。載於陳秋江、許書劍(主編)，**外科急症**(頁 5-13)。台北：當代醫學雜誌社。

期刊文章：

顏秀紅 (民 73)。簡介美國幾家醫院職能治療之近況。 **職能治療學會雜誌**, 2, 79-82。

Shalev, L., & Tsal, Y. (2006). The wide attentional window: A major deficit of children with attention difficulties. *Journal of Learning Disabilities, 36*, 517-527.

翻譯圖書：

美國心理協會(American Psychological Association)(1997)。 **美國心理協會出版手冊第四版 (中譯二版)**(Publication manual of the American Psychological Association, 4th ed.) (王明傑、陳玉玲譯)。台北：雙葉。(1994)

(註：1997 是譯本之出版年；1994 為原著出版年。)

會議及座談會之會議紀錄：

Deci, E. L., & Ryan, R. M. (1991). A motivational approach to self: Integration in personality. In R. Dienstbier (Ed.), *Nebraska Symposium on Motivation: Vol. 38. Perspectives on Motivation* (pp. 237-288). Lincoln, NE: University of Nebraska Press.

七位以上作者：

Clark F., Azen, S. P., Zemke, R., Jackson, J., Carlson, M., Mandel, D., ... Heaton, R.K. (1997). Occupational therapy for independent-living older adults. *Journal of American Medical Association, 278*, 1321-1326.

叢書中一卷的一章：

Maccoby, E. E., & Murtin, J. (1983). Socialization in the context of the family: Parent-child interaction. In P. H. Mussen (Series Ed.) & E. M. Hetherington (Vol. Ed.), *Handbook of child psychology: Vol. 4. Socialization, personality, and social development* (4th ed., pp. 1-101). New York: Wiley.

排印中期刊文章：

Zuckerman, M., & Kieffer, S. C. (in press). Race differences in fascism: Does facial prominence imply dominance? *Journal of Personality and Social Psychology*.

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