Intrinsic and Extrinsic Factors Important to Manual Therapy Competency Development: A Delphi Investigation

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Abstract: A learner's development of orthopaedic manual physical therapy (OMPT) psychomotor skills may be influenced by selected intrinsic and extrinsic factors. The purposes of this study were to identify the factors that influence learners' development of manual physical therapy competencies and to define each factor as intrinsic or extrinsic. A 3-round Delphi method survey and a retrospective review of the data were used to develop composite scores and rankings. Eighty manual physical therapy educators participated in the 3 rounds. Thirty-six factor descriptor statements associated with manual physical therapy competency were established and further categorized as intrinsic (19 total), extrinsic (10 total), or conceptual outliers (7 total). Cognitive Processing ranked as the most important factor influencing manual physical therapy competency development. Adaptation ranked second, followed by Science Knowledge. This study is the first to establish manual physical therapy educational factors associated with attainment of competency. The majority of the factors distill into the theory of extrinsic and intrinsic factors identified by Schmidt and Lee. The outcomes of this study identify the factors to which OMPT educators should give particular attention when developing and executing the learning experiences for their learners.

Keywords: Competency-Based Education, Curriculum, Delphi Technique, Factors, Motor Learning, Musculoskeletal Manipulations, Psychomotor Performance.

Specific manual and/or movement-based competencies are emphasized by physical therapy educators during learners' development of psychomotor skills. Psychomotor skill acquisition is a product of psychomotor learning, which is a set of processes associated with practice or experience leading to relatively permanent changes in the capability for responding to stimuli[1]. As a consequence of psychomotor learning, individuals gain greater movement efficiency, develop more complex movement control strategies, optimize movement behaviors, and develop movement expertise[2].

Schmidt and Lee identified five extrinsic and four intrinsic factors that influence psychomotor learning[1]. The extrinsic

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factors are 1) practice, 2) feedback, 3) task classification, 4) instruction format, and 5) movement context. Factors such as practice, which involves cognitive processing[3,4], accentuate learned abilities through the processing of sensory information[5]. The use of quantitative feedback and concurrent feedback in manual physical therapy learning has provided both favorable[6-8] and unfavorable results[9]. Visual instructional formats incorporate observation to facilitate psychomotor skill acquisition[10], while kinesthetic instruction uses the learner's sensory system by physically moving the learner through the task[11]. Finally, movement context appears to influence psychomotor skill acquisition[12].

The intrinsic factors include 1) attention, 2) memory, 3) motivation, and 4) psychomotor learning stage[13]. These factors are less tangible and more difficult to measure than the extrinsic factors. Different stages of learning result in differences in skill processing[13,14]. In the early cognitive stage, individuals manage information in an intellectual fashion, focusing on factual components of the skill and giving less consideration to perception or implementation[15]. Attention, task complexity, and motivation impact psychomotor learning during this stage of motor learning[10,16]. In the associative stage, learners refine the psychomotor task through repetition and practice. During this stage, the learners recognize movement errors and develop correction strategies[17]. Progression toward expertise occurs in the automaticity stage, as complex skills are connected and refined[18.] Memory appears to influence psychomotor skill development within these stages[19,20], where explicit memory engages intentional recall and recognition of information, events, or actions. Conversely, implicit memory involves a psychomotor performance change that taps into a memory of psychomotor events without conscious reference to any particular prior episode or experience and is especially used during the acquisition and control of psychomotor skills.

For orthopaedic manual physical therapists, the acquisition of psychomotor skills embodies the definition of competency. The *Guide to Physical Therapist Practice* defines manual physical therapy techniques as "skilled hand movements intended to improve tissue extensibility; increase range of motion; induce relaxation; mobilize or manipulate soft tissue and joints; modulate pain; and reduce soft tissue swelling, inflammation, or restriction[21]." The International Federation of Orthopaedic Manipulative Therapists (IFOMPT) further classifies orthopaedic manual therapy as "... a specialized area of physiotherapy/physical therapy for the management of neuromusculoskeletal conditions, based on clinical reasoning, using highly specific treatment approaches including manual techniques and therapeutic exercises[22]."

While investigators have identified factors that influence psychomotor learning, no study has evaluated those factors that are associated with the development of manual therapy competencies. While educators could expect the development of manual therapy competencies to be influenced by the same factors as any other motor skill developmental process, a consideration of the factors associated with manual therapy competency development could assist educators in fashioning an effective learning process.

There were two primary purposes to this study. First we endeavored to ascertain consensus among manual physical therapy educators regarding the factors that influence learners' development of manual physical therapy competencies. Second, we were interested in how extrinsic and intrinsic factors identified by the manual therapy educators corresponded with previously published intrinsic and extrinsic psychomotor learning factors[1]. Examining the consistency of these factors with previous literature would not only appraise the consistency between modern manual physical therapy educator perspectives and classical motor learning literature, but it would additionally help to identify those factors that may be unique to manual therapy competency development.

Methods

Subjects

This investigation implemented a Delphi survey instrument that incorporated both a work and respondent group[10]. The work group was composed of a physical therapist investigator experienced in manual physical therapy and two other individuals experienced in qualitative research. The latter two individuals were formally trained in health care disciplines outside of physical therapy without manual physical therapy experience. The work group summarized the data returned by the respondent group from Round 1 and redesigned the follow-up instruments.

Survey respondents were selected for their expertise in OMPT education, as evidenced by their serving currently as educators in OMPT. Survey respondents were solicited from every electronically accessible setting in the United States: (1) Faculty of professional physical therapy education settings (labeled *professional respondents*); and (2) faculty of post-professional education settings (labeled *post-professional respondents*), including graduate programs within a university, fellowship programs, and continuing education programs. In order to participate, the respondents had to meet several inclusion criteria, which included (1) a willingness to participate; (2) a thorough knowledge and experience in the practice of OMPT, in that they practiced OMPT during their career as physical therapists; and (3) experience in teaching OMPT in a professional and or post-professional setting. Compliance with these criteria was established when respondents answered the demographic section in Round 1.

Research Design

There were two primary aspects of this study: (1) a Delphi method investigation and (2) a retrospective evaluation of the findings of the Delphi. A Delphi method involves inquiry of targeted "experts" and generally consists of three rounds of targeted inquiry, designed to gain knowledge of an esoteric concept that lacks quantitative information[23,24]. The retrospective evaluation of the Delphi findings was designed to identify the intrinsic and extrinsic factors advocated by the Delphi participants and to distill the consensus descriptor statements into Schmidt and Lee's intrinsic and extrinsic psychomotor learning categories[1].

Instrumentation

This study incorporated a web-based, 3-round Delphi survey instrument that has been previously described in detail[23,24]. A summary of the Delphi process used during this study is shown in Figure 1. Round 1 included three successive sections. Section 1 focused on respondent demographic information, section 2 provided definitions regarding the Delphi instrument, and section 3 provided an open-ended question asking respondents to identify the factors that would most influence the development of OMPT competencies.

The Round 2 instrument was composed of a list of factor descriptor statements constructed from the work group's qualitative analysis of Round 1. Using these descriptor statements, respondents were asked to evaluate the importance of each factor's influence on OMPT competency development with a modified Likert scale that included the following ratings: (1) not at all important, (2) moderately unimportant, (3) moderately important, and (4) essential. Round 3 was comprised of the same descriptor statements as in Round 2, with additional graphical frequency scoring for each descriptor statement from Round 2 (Figure 2). Respondents were instructed to view the frequency score, and then re-evaluate the descriptor statement using the same modified Likert scale as before.

Procedure

The experiment was granted institutional review board approval at Texas Tech University Health Sciences center in the spring of 2002. Invitations to the Round 1 instrument were automatically distributed through email to all qualified respondents from web search and evaluation of written university listings. Respondents accessed the web-based instrument and consented to participate by clicking on a consent statement within the web page.

For Round 1, respondents were asked to identify factors that arise from within or outside the learner that are deemed necessary to learners for developing OMPT competencies. After respondents completed Round 1, the WebSurveyor program (v3.6, WebSurveyor Corp., Herndon, VA) automatically downloaded response data into a spreadsheet for work group analyses. Work group members (WGM) coded each skill data entry, whereby multiple factors within a single statement were separated and evaluated as separate entries. WGM then made coding decisions for each data entry based on how each item was grouped into common themes or issues[25].

For coding, WGM first performed a quantitative analysis. Here, data entries were coded based on similar words or phrases (literal coding), where entries were first coded when they shared the same (or similar) words. Each member then categorized the word groupings with terms such as Cognitive Processing, Adaptation, or Science Knowledge. Then the remaining data entries were qualitatively coded into the categories based on similar meanings and contexts. For example, "the degree to which a learner is motivated to learn manual therapy was entered into the category Motivation. When a data entry did not fit into initial categories, then a new category was created.

After individual coding, the work group began the group coding process, whereby each individual data entry was discussed and entered into a category when all three WGM had agreed on the assignment. Discussion was initiated during disagreements and closed when the group reached unanimous agreement and the data entry was coded, or when the members agreed to disagree and the entry was discarded.

After group coding, the work group created descriptor statements for Round 2. Each descriptor was given a title and a brief explanatory statement that supported the title. For example, the work group used the title *Adaptation: The learner's capacity to self-assess and adapt* to represent data points that described all aspects of adaptation and self-assessment.

The Round 2 and 3 web links were each distributed through email to all respondents from Round 1. After respondents completed Round 3, the *WebSurveyor* program downloaded response data, and the number of responses for each descriptor statement was tallied for use in statistical analyses. In addition, the WGM principal investigator (PS) and a non-work team individual (CC) individually and then collectively distilled the consensus descriptor statements into Schmidt and Lee's intrinsic and extrinsic psychomotor learning categories. Neither individual was blinded to the Delphi findings and rankings. Subsequently, both members met to discuss their categories and collectively created a retrospective master list of factors that were intrinsic, extrinsic, or outlier.

Data Analysis-Delphi Method

For each factor, the scores from Round 3 were separated into two categories. The responses of *Not at all important*

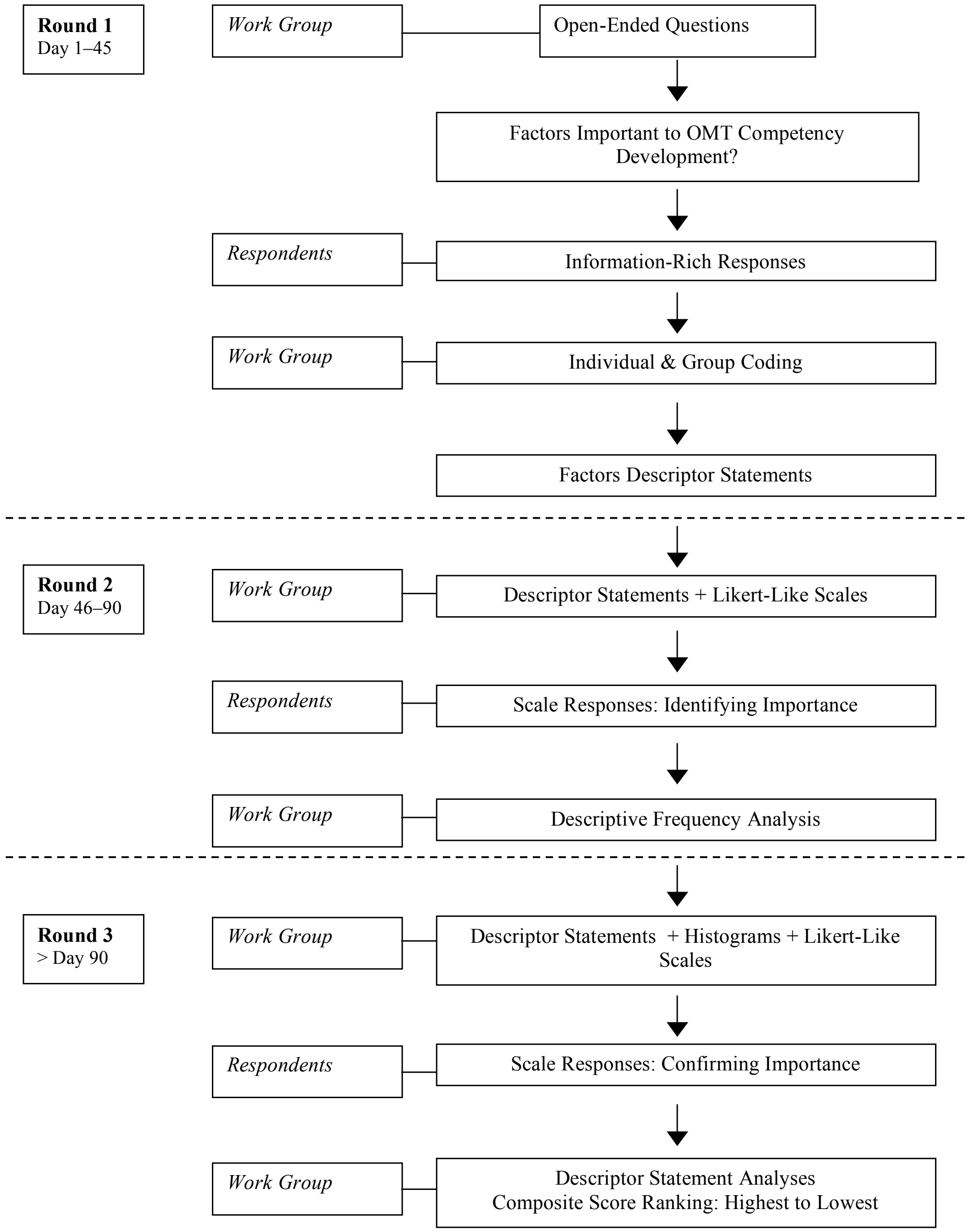

Fig. 1. A summary of the Web-based Delphi process for the present study.

and *Moderately unimportant* represented the total percentage of scores in the "No" category, meaning that the presence of the factor is not important for acquisition and development of manual physical therapy competencies (Figure 2). Conversely, the responses of *Moderately important* and *Essential* were placed in the "Yes" category, meaning that the presence of the factor is important for that acquisition and development.

Consensus regarding a factor was operationally defined as when 75% or more of the respondents scored a factor as a No or Yes[26]. Figure 2 provides an example of consensus-scoring. If the percentage score for No or Yes was between 50 and 74.9%, then consensus was not established and a decision was forced between *Near-consensus* and *Undecided*[27].

To complete the decision between *Near-consensus* and *Undecided*, a logic analysis was conducted. If the percentage score for *Moderately Important* and *Essential* was greater than the percentage score for *Moderately Important* and *Moderately Unimportant*, then the factor was labeled as "*Near-Consensus, Important* (NCI). Similarly, if the score for *Moderately unimportant* and *Not At All Important* was greater than the score for *Moderately Important* and *Moderately Unimportant*, then the factor was labeled as *Near-Consensus, Not Important* (NCNI). However,

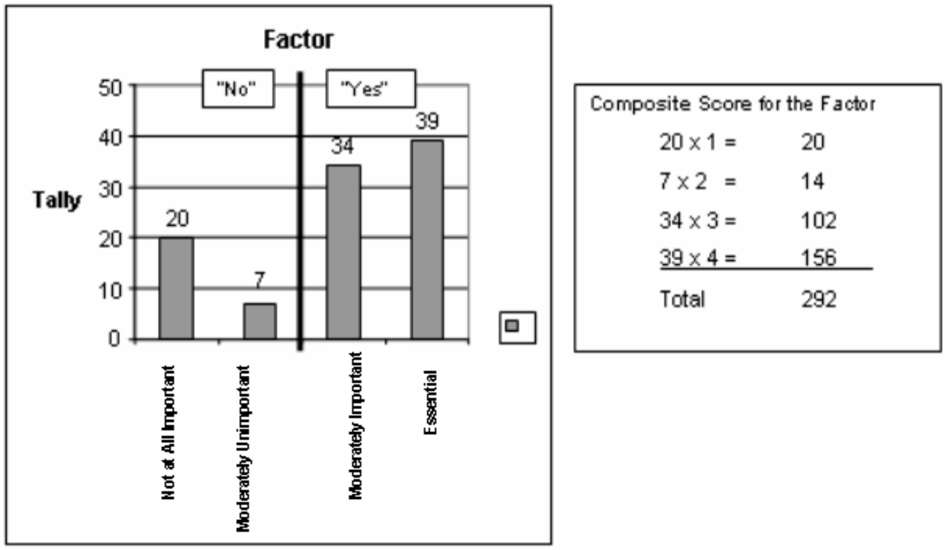

Fig. 2. Sample Round 3 graphic depiction of the Likert scale frequency score for a descriptor statement. The number of respondents who selected each score is graphically depicted. Not at All Important and Moderately Unimportant scores were categorized as No scores, while Moderately Important and Essential scores were categorized as Yes scores. A sample composite score tally for factor descriptor statement from Round 3 data analysis is provided, where the number of respondents selecting each score is multiplied by a score value of 1, 2, 3, or 4 for each respective score category.

if the score for *Moderately Important* and *Moderately Unimportant* was greater than the score for *Moderately Important* and *Essential* or the score for *Moderately Unimportant* and *Not at all Important*, then the factor was labeled as *Undecided* (U).

Subsequently, the factor descriptor statements were ranked by importance by first assigning an ordinal composite score to the factor descriptor. For descriptor statement ranking, the composite score was determined using the following formula:

Composite Score = (p1 x 1) + (p2 x 2) + (p3 x 3) + (p4 x 4)

Where:

p1 = % of respondents who scored the factor as *Not at all important*

p2 = % of respondents who scored the factor as *Moderately unimportant*

p3 = % of respondents who scored the factor as *Moderately Important*

p4 = % of respondents who scored the factor as *Essential*

A graphical example of this composite score is presented in Figure 2. Consequently, the skill in Figure 2 was assigned a composite score of 292.

Results

Results from Round 1

A total of 388 physical therapy educators were solicited for participation in the present study. Of the 388 individuals, 42 were inaccessible due to incorrect electronic mail address, server difficulties, or relocation without a new address. A total of 109 individuals (31.5% of the 346 contacted persons) responded to Round 1 of the Delphi instrument. Descriptive data from Round 1 was only recorded for the respondents who completed all three rounds (n = 80). These respondents reported a mean of 18.5 years as licensed physical therapists. Of the subjects, 54 were male and 25 were female; one respondent failed to answer this question. Sixty-five of the respondents (81.3%) indicated present engagement in a clinical practice, with a mean of 18.3 hours per week in the clinic. The summary of descriptive data for respondent experience demonstrates variability in years of practice and types of settings (Table 1). The 109 initial respondents provided 608 factor data points that were further sub-categorized by the

TABLE 1. Summary of descriptive data for respondent experience (N=109).

	Professional-Level	Post Professional-Level	Post-Graduate Fellowship	Continuing Education
Number of respondents from the setting	62	12	17	30
% Teaching time in the setting, range (mean)	5–100% (83.8%)	2–100% (31.7%)	5–100% (49.1%)	1–100% (38.5%)
Years teaching in the setting, range (mean)	1–22 (9.1)	1–22 (10.8)	1–11 (5.5)	1–25 (9.7)
Number of respondents teaching > 50% in the setting	55	3	7	10
Number of respondents teaching < 50% in the setting	6	9	10	20
# of states represented by the setting	32	9	8	15

WGM. Group coding produced 36 factor descriptor statements that served as the evaluative factors for Rounds 2 and 3 (Tables 2–4).

Results from Rounds 2 and 3

Ninety-four respondents completed Round 2 (86% single round retention rate); while eighty respondents completed Round 3 (85% single round retention rate). The total scoring tallies of factors for Rounds 2 and 3 are reported in Tables 2–4. A total of 30 of the 36 descriptor statements reached consensus as being important for manual physical therapy competency development (Consensus Important [CI]), whereas 6 were undecided (U). Descriptor rank outcomes, as well as the descriptions of each descriptor published in the survey and identification of factor type (*intrinsic* versus *extrinsic*), are reported in Tables 2–4. Overall, Cognitive Processing ranked as the most important factor that influences the development of manual therapy competencies, followed by Adaptation, Feedback-Quality, and Science Knowledge, which tied as the third most important factor, followed by Application as the fourth most important factor. Assessment and Sense of Feel ranked fifth and sixth, while Practice-Quantity, Motivation, Confidence in Touch, and Observation ranked seventh through tenth, respectively. Conversely, the six descriptors in the rank outcomes that were considered undecided (U) were Physical Environment, Intuition, Patient Characteristics, Physical Strength, Physical Flexibility, and Athletics.

Retrospective Findings

Tables 2–4 outline the categorization of the intrinsic, extrinsic, or conceptual outlying factors. Comparison of categorization yielded a 61% agreement after individual analysis and a 100% agreement by the retrospective work team during collective analysis. Nineteen (19) factors were identified as *intrinsic* and 10 factors were identified as *extrinsic*. Seven factors did not appear to correspond with any of the Schmidt and Lee categories and were thus identified as *conceptual outliers*[1]. Five of the seven of the conceptual outliers failed to achiever consensus in the Delphi responses.

Discussion

The data substantially supported an association with contemporary theory of motor learning[1], producing 30 factors that reached consensus regarding their association with the development of OMPT competency. This study used a Delphi survey method to define learning criteria essential for attaining OMPT competency. The Delphi technique is useful in situations where frequent clinical or practical judgments are encountered, but empirical evidence to provide evidence-based decision-making does not exist[28]. Individuals originally solicited for participation in the present study represented OMPT physical therapy educators within the United States, from both the professional and post-professional settings.

We feel the findings in this study are highly reflective of most OMPT educators within the United States. First, the response rate for all three rounds was respectable (22%), considering typical electronic-based survey response rates[29], and each demonstrated a strong retention rate for each subsequent round. Additionally, little empirical evidence exists as to whether having more participants within a Delphi affects the reliability or validity of a consensus process[30]. Moreover, the Delphi process does not require expert panels to be representative samples for statistical purposes, nor is a specific volume required for appropriate sampling validity[31].

The mean value for years of experience suggested that the respondent pool was experienced in the field, signifying

TABLE 2. Grouping of intrinsic factors using Schmidt and Lee's Motor Learning Criteria.

Factor Heading	Description	Consensus Status	Rank
Learning-Cognitive Phase			
Cognitive Processing	The learner's cognitive processing, including critical thinking, decision-making, and problem-solving.	CI	1
Science Knowledge	The learner's knowledge of basic and applied science, such as anatomy, , physiology and biomechanics.	CI	30
Observation	The learner's use of observation.	CI	10
Manual Therapy Knowledge	The learner's knowledge regarding manual therapy applications	CI	18
Learning-Associative Phase			
Adaptation	The learner's capacity to self-assess and adapt.	CI	2
Application	The learner's application of knowledge to skill and skill to patient care.	CI	4
Assessment	The learner's assessment of self, patients, and data.	CI	5
Experience	The learner's experience with patient care and the specific use of manual therapy techniques.	CI	20
Learning-Automatic Phase			
Confidence on Touch	The learner's confidence in touching people.	CI	9
Self-Confidence	The learner's level of self-confidence.	CI	23
Memory			
Sense of Feel	The learner's sense of feel for tissue, tone, and movement.	CI	6
Sensory Function	Normalcy in the learner's sensory function, including detection, discrimination, and processing.	CI	14
Proprioception	The learner exhibiting intact position sense, motion sense, stereognosis, and kinesthesia.	CI	16
Memory	The learner's level of memory and recall.	CI	25
Attention			
Attention	The learner's level of attention, concentration, and focus.	CI	11
Attention to Detail	The learner's attention to detail.	CI	13
Motivation			
Motivation	The learner's level of motivation.	CI	8
Commitment	The learner's commitment, desire, and dedication to developing manual therapy competencies.	CI	13
Patience	The learner's level of patience.	CI	21

CI = Consensus that the factor was important for manual therapy competency

U = Undecided whether the factor was important for manual therapy competency

expertise in the practice of physical therapy. In addition, the majority of respondents reported maintaining a clinical practice, with nearly 50% of the working week as their mean number of hours per week in that setting. This suggests that the respondents consistently continued in clinical practice despite their roles as educators.

With the exception of seven factors, all Delphi-generated factors associated with competency in learning OMPT were retrospectively itemized into either intrinsic or extrinsic motor learning categories. More factors fell into the intrinsic factor categories versus the extrinsic factor categories, and a preponderance of selections fell into the stages of psychomotor motor learning categories, suggesting that an educator's awareness of how the learner is engaging in the various stages of psychomotor learning across time is essential for OMPT competency development. Thus, an educator should attend to how the learner is processing the psychomotor experience and select skill development strategies that optimize that learner's place along the staging continuum.

Several of the factors that were identified by respondents appear similar to those identified by Schmidt and Lee[1]. However, although Schmidt and Lee were instrumental in describing the intrinsic and extrinsic factors that generally influence psychomotor skill acquisition, their descriptions lack specificity when applied to the development of OMPT competencies, leaving educators wanting for specific ways to optimize methods of educational instruction. This study is the first to describe specific factors that influence OMPT psychomotor skill development that may be modified by the educator. In response, the factors were further categorized and will be described in terms of Schmidt and Lee's[1] original work (Tables 2–4).

The retrospective grouping of intrinsic factors yielded 19 individual factors that represent all four of Schmidt and Lee's[1] motor learning intrinsic factors (Table 2). The predominant category included the psychomotor learning stages, which enveloped 10 of the 19 factors. This finding is reasonable, since OMPT clinicians typically engage in educational processes through professional education, post-professional certification, and or clinical fellowship, as well as post-professional degree programs. Although the duration of these models varies, each program requires a substantial time and learning commitment, ranging from a few months to several years beyond entry-level physical therapy education. The present data suggest that respondents appreciate the personal qualities and commitment that are required of clinicians when engaging in OMPT education programs, especially when executed in combination with full or part-time clinical employment and the demands of adult life. Moreover, having a greater number of the factors found in the intrinsic category suggests that the development of manual physical therapy competencies is heavily influenced by factors that the learner processes internally, rather than factors that are found external to the learner.

The top five ranked factors fall into the intrinsic category and merit special attention. Cognitive Processing (ranked 1st) is relevant during the cognitive learning stage and includes critical thinking, decision-making, and problem-solving. One could surmise the value of reflective processes[32-35] to OMPT education and skill development[34], based on their importance in hypothesis testing[32,36,37] and management strategy development[38]. Adaptation (ranked 2nd) characterizes the associative psychomotor learning stage. Clinical adaptation can be based on Assessment (ranked 5th), and they are both exercised during all aspects of a learner's manual therapy experience. Learners must constantly assess and adapt how they are thinking and responding with respect to what they see and experience. This reflective process can guide them toward making effective clinical and evidence-based decisions regarding implementation and modification of testing and treatment procedures[26]. In a similar way, a learner's *Application* of knowledge to skill and skill to patient care (ranked 4th) reflects the link of theory to practice, which is essential for effective clinical learning to occur[39]. Individuals who are developing OMPT competencies are asked to apply complex information, concepts, and models to each patient examination and management encounter, especially as those skills mature. Science Knowledge (ranked 3rd) serves as the bridge between learners' general cognitive abilities and their skill-based, psychomotor performance[40]. This suggests that science is the foundation that connects general knowledge with practical application. Without scientific knowledge, skill-based performance may be aimless and without purposeful outcome. Thus, effective application of manual therapy intervention requires that clinicians execute both intellectual processing and complex psychomotor skill performance[41,42]. Theoretical content must reflect basic and applied science foundations in anatomy, biomechanics, pathology, psychology, and tissue physiology[41,43]. This content can serve as the basis for clinical algorithms, decision-making, clinical application guidelines, and management strategies, which serve as the didactic portion of a manual therapy educational session[42].

Extrinsic factors made up 10 of the 36 selected factors. All but one of the ten reached consensus and were considered essential factors for OMPT competency development (Table 3). However, there was a notable absence of factors that fell into the *task classification* category as proposed by Schmidt and Lee[1]. Tasks can be classified as *discrete* versus *continuous*, as well as *closed* versus *open*[1,14]. A discrete task is one with a specific start and finish with a specific movement goal, such as a high-velocity thrust OMPT manipulation. Continuous tasks are those that have no recognizable beginning or end and are rather cyclic in nature, such as slow-velocity OMPT oscillations. A closed task is one in which the subject's movement is limited by fixed elements in the environment, such as using a manipulative thrust to a prone patient on a treatment table. Conversely, open tasks are executed when the learner moves amidst environmental factors that also are moving, such as a mobilization with movement at the glenohumeral joint during shoulder elevation, where the direction of mobilization changes as the scapula swings upwards and retracts. There are two possible reasons for no factors identified in this category. First, clinicians may be unaware of this form of movement categorization. Second, because all of these types of movements are

TABLE 3. Grouping of extrinsic factors using Schmidt and Lee's Motor Learning Criteria.

Heading	Description Status	Consensus	Rank
Practice			
Practice Quantity	The quantity of the learner's practice at manual therapy activities.	CI	7
Practice Type	The type of practice used by the learner when practicing manual therapy (e.g., variable practice, guided practice, mental practice).	CI	17
Feedback			
Feedback Quality	Quality of feedback given to the learner, including the type and timing of the feedback.	CI	3
Communication	The learner effectively sending and receiving, both verbally and non-verbally.	CI	15
Feedback Quantity	The quantity of the learner's practice at manual therapy activities.	CI	22
Instructional Format			
Demonstration	Manual therapy techniques being demonstrated or modeled to the learner.	CI	12
Teaching	The method, style, and quality of manual therapy instruction given to the learner.	CI	18
Mentoring	The learner's interaction with an accomplished mentor.	CI	19
Movement Context			
Equipment	Availability of proper equipment, such as treatment tables.	CI	26
Physical Environment	Variations in lighting, noise, or temperature within the learning environment.	U	30

CI = Consensus that the factor was important for manual therapy competency
U = Undecided whether the factor was important for manual therapy competency

TABLE 4. Outliers using Schmidt and Lee's Motor Learning Criteria.

Heading	Description	Consensus Status	Rank
Personal Qualities	The learner's personal qualities, including character, discipline, inquisitiveness, and pride.	CI	24
Endurance	The learner's level of endurance, including muscular and postural endurance.	CI	27
Intuition	The level of the learner's intuition.	U	28
Patient Characteristics	The characteristics of the patient (e.g., patient size).	U	29
Physical Strength	The learner's level of physical strength.	U	31
Flexibility	The degree of the learner's physical flexibility.	U	32
Athletics	The learner's experience with athletics and or the performing arts, such as dance.	U	33

CI = Consensus that the factor was important for manual therapy competency
U = Undecided whether the factor was important for manual therapy competency

equally important to OMPT competency development, they may not have been viewed as discriminating factors.

Seven factors failed to fall discreetly into any of Schmidt and Lee's categories of motor learning. Consequently, these factors, two of which met respondent consensus and five that did not, are discussed separately as a group of conceptual outliers. Two factors did reach consensus among the respondents, Intuition and Personal Qualities. At present, there is no literature that reflects personal qualities with OMPT. Intuition is a component of the critical thinking process[44] and is considered to be knowledge that is not acquired through analytical reasoning, but rather through an immediate interaction of the clinician's wisdom, experience, and personality with surroundings, context, and patient response[16,45]. Clinicians appear to be increasingly capable of using intuition or a *gut-feeling* that can guide clinical decision-making as their clinical expertise grows[45,46]. However, it is surprising that OMPT educators were undecided about this factor, as it may serve clinicians in the decision-making processes that are incorporated in OMPT examination and management of patients.

Respondents were undecided about the role of a patient's Characteristics (ranked 29th) in competency development. While research is not available on this topic and respondents' personal physical sizes were not evaluated in the present study, the scoring could have been related to different respondents' experiences with large patients based on personal size. Although respondents were undecided regarding the role of Physical Strength (ranked 31st) for manual therapy competency development, Endurance (ranked 27th) reached consensus as being important. While manual therapy clinicians are required to perform skills that engage numerous muscle groups for extended periods of time, the forces required for the application of OMPT techniques are not necessarily great. Equally as interesting is the respondents' scoring of Flexibility (ranked 32nd), where respondents were undecided about this factor. This finding is interesting in light of the literature, which has demonstrated flexibility's negative effect on select dimensions of ballistic human performance[47,48]. This deleterious effect could influence the performance of high-velocity manual therapy maneuvers, such as thrust manipulation. While this influence must be investigated, there is no evidence that suggests that the clinician's flexibility improves the performance of manual therapy skills.

Finally, while one could assume a positive influence of Experience in Athletics (ranked 33rd) on manual therapy competency development, the respondents were undecided about the role of this factor on competency development. One could propose that the requirements of speed, directional change, control, and coordination of movements associated with athletics could be generalized to one's performance of selected manual therapy skills[1]. However, it did not appear that the respondents agreed with this notion.

Limitations

The Delphi approach has fallen under scrutiny as a valid approach to establishing consensus. While selected authors have judged the method as objective[49,50], others have suggested it falls short of other scientific methods and at best it serves to describe information in the absence of criterion standards[28]. Nonetheless, the Delphi approach has been recently used to establish consensus regarding diagnostic examination issues relevant to OMPT[23,24,51].

The Delphi approach is qualitative in nature, making it exempt to sampling requirements of a randomized design[52]. As suggested, 22% of the targeted population responded to the entire 3-round process. While respectable, there may be two issues that could have limited the response rate. First, a number of respondents did not have access to the web-based survey instrument, due to browser incompatibilities or personal hardware limitations and web access. Second, the study was conducted over the late spring and summer months during the time when educators frequently take vacation, a limitation verified retrospectively during verbal discussion with several respondents from Rounds 1 and 2.

Conclusion

The findings of this study did substantially support an association with Schmidt and Lee's theories of motor learning and yielded 30 factors that reached consensus. There are several key findings in this manuscript:

1. The Delphi respondents identified several factors associated with the development of OMPT competency.
2. Most of the consensus-selected factors associated with competency in learning OMPT were itemized into either intrinsic or extrinsic motor learning categories.
3. More factors fell into the intrinsic factor categories than into the extrinsic factor categories.
4. Numerous selections fell into the stages of psychomotor motor learning categories, suggesting that temporal learning is essential for OMPT competency.

Educators are encouraged to engage in implementing learning strategies that keep these considerations in mind. Attention to these factors may enhance the delivery of OMPT education and the learners' development of OMPT competencies. Future studies should investigate the effect of targeted selected motor learning scenarios for OMPT competency. Furthermore, querying OMPT educators to determine how they provide learning opportunities that are associated with these factors may improve the educational process and OMPT skill development. ■

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