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Predictors of Clinical Reasoning Using the Reasoning 4 Change Instrument With Physical Therapist Students

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Abstract

Background. Although physical therapist students must be well prepared to integrate biopsychosocial and behavioral perspectives into their clinical reasoning, there is a lack of knowledge regarding factors that influence such competence.

Objective. This study explored the associations among the independent variables: knowledge, cognition, metacognition, psychological factors, contextual factors, and curriculum orientation vis-à-vis behavioral medicine competencies; and the dependent variables: outcomes of input from client (IC), functional behavioral analysis (FBA), and strategies for behavior change (SBC) as levels in physical therapist students' clinical reasoning processes.

Design. This study used an exploratory cross-sectional design.

Methods. The Reasoning 4 Change instrument was completed by 151 final semester physical therapist students. Hierarchical multiple regression analyses for IC, FBA, and SBC were conducted. In the first step, curriculum orientation was inserted into the model, followed by self-rated knowledge, cognition, and metacognition in the second step, and psychological factors in the third step.

Results. All independent variables except contextual factors explained 37% of the variance in the outcome of IC. Curriculum orientation explained 3%, cognitive and metacognitive factors an additional 22%, and attitudes another 15%. Variance in the outcomes of FBA and SBC were explained by curriculum orientation only (FBA change in $R^2 = 0.04$ and SBC change in $R^2 = 0.05$). Higher scores of the dependent variables were associated with a curriculum with behavioral medicine competencies.

Limitations. The limitations of this study are that it was cross-sectional.

Conclusions. Cognitive and metacognitive capabilities and skills and positive attitudes are important predictors of physical therapist students' clinical reasoning focused on behavior change at the IC level. Curricula with behavioral medicine competencies are associated with positive outcomes at all clinical reasoning levels.

Background

Clinical reasoning is a cornerstone of entry-level physical therapist education.^{1,2} It provides the students with an established knowledge base, shapes their strategies and skills, and promotes effective systematic approaches to their reasoning processes.³ Generally, clinical reasoning refers to health professionals' thinking and decision-making processes that guide practical actions.⁴ According to the World Confederation for Physical Therapy's (WCPT) guidelines for entry-level education,² students should develop clinical reasoning competence incorporating reflection, a holistic view, and the client's perspective to enhance outcomes. Based on evidence and expert agreement, physical therapists must be well equipped with competencies regarding psychosocial aspects of and behavioral considerations in assessment and intervention, i.e., in the clinical reasoning process.⁵⁻⁸ Physical therapist students' clinical reasoning involves a multifaceted picture with considerable variability⁹ but is still frequently characterized by limited reflectivity¹⁰ and a dominant biomedical, therapist-centered approach.¹¹ Even though studies have examined characteristics of students' clinical reasoning, they have provided minimal insight into what factors contribute to students' clinical reasoning skills.

No consensual agreement has been reported regarding the nature, relevant components, and boundaries of clinical reasoning.^{12,13} Within physical therapists' practice, clinical reasoning has been described as gathering and synthesizing information to identify the client's problem and its consequences, generating hypotheses, formulating an intervention plan, and evaluating the outcomes.¹⁴⁻¹⁶ The reasoning is contextual, characterized by collaboration to understand the client's perspective^{17,18} and cognitive and reflective abilities are needed for making informed decisions.^{16,18}

Further, a theory- and evidence-based clinical reasoning process is characterized by strategies supporting behavior change for a client's benefit.¹⁹ Related behaviors encompass both external actions, such as movements and actions, and their internal counterparts, such as thoughts and feelings. Interventions can be applied to strengthen, maintain or weaken behaviors.²⁰ Clinical reasoning that integrates behavioral considerations focuses on activity-related target behaviors, which comprise activities that must be modified to improve the client's health or activities that challenge the client because of pain, illness, or disability.²¹ Key components in this non-linear clinical reasoning process include the input from client (IC), comprising history taking and assessments to collect biopsychosocial data relevant for the target behavior, a functional behavioral analysis (FBA) including hypotheses about the relationships among factors associated with the target behavior, and the selection of strategies in the intervention to support behavior change (SBC).¹⁹ However, application in practice has been shown to challenge clinicians^{7,22,23} as well as students.²⁴ Students' clinical reasoning patterns often lack the behavioral perspective in assessment and intervention.¹¹ Extensive research emphasizes the need for curricula, education and training to enable physical therapists integrate psychosocial and behavioral strategies into client management.^{5-7,22,25,26} Efforts have been made to meet these needs by integrating behavioral medicine competencies into physical therapist entry-level curriculum. In such curriculum, movement and function are conceptualized as behaviors, and a reciprocal interaction between peoples' daily life behaviors and biopsychosocial factors is in focus in assessment, analysis, intervention and evaluation.²⁷ The rationale is based on, among other factors, a holistic view of health consistent with the International Classification of Functioning, Disability and Health,²⁸ the maximizing of health by health promotion and management of lifestyle related diseases prioritized by the WCPT,²⁹ and evidence for behavior modification to improve client outcomes.²⁷ To maximize students' clinical reasoning proficiency, awareness of factors affecting students' biopsychosocial clinical reasoning, with a focus on clients' behavior change, is essential.

Models and frameworks of clinical reasoning^{4,14,30,31} may augment understanding of its primary influencing factors. According to a model of clinical reasoning focused on clients' behavior change (CRBC-PT),¹⁹ the reasoning process develops from the physical therapist's specific knowledge, analytical and metacognitive capabilities and skills, and psychological and contextual factors, in interaction with client factors. To date, the only instrument quantitatively assessing physical therapists' clinical reasoning in integration with clients' behavior change is the Reasoning 4 Change (R4C) instrument,^{32,33} which is based on the model of CRBC-PT.¹⁹ Empirical studies based on observations of and interviews with physical therapists have identified many internal and external factors that may influence clinical reasoning, for example, knowledge and experience,^{15,18,34,35} cognitive capability,^{14,16,34} reflection,¹⁸ emotions,³⁶ reasoning strategies,¹⁴ situational circumstances,^{15,16,34,35} and the physical therapist's perspective of the client.^{14,35,37,38} A recent systematic literature review revealed a multifactorial picture that includes the physical therapist, client, context, and elements of the reasoning process. The individual physical therapist was identified as the dominant influencing factor.³⁹ Later research, examining clinical reasoning in physical therapist students, strengthens this evidence.¹¹ However, these associations are based on qualitative studies, and no statistical correlations among key variables have been reported. Further studies investigating the impact of individual and educational specific factors on physical therapist students' clinical reasoning skills are warranted,¹¹ and large multisite studies have been called for.⁴⁰ Identification of potential variables that are based on theory and research has also been called for.^{41,42} Thus, the model of CRBC-PT¹⁹ and previous research about influencing factors^{4,14,15,37,39,43,44} were considered appropriate to inform the selection of independent and dependent variables in the current study.

To better elucidate the clinical reasoning process used by physical therapist students related to client behavior change, the objective of this study was to explore the associations among the independent variables: knowledge, cognition, metacognition, psychological factors, contextual factors,

and curriculum orientation vis-à-vis behavioral medicine competencies; and the dependent variables: outcomes of IC, FBA, and SBC as levels in physical therapist students' clinical reasoning processes.

Method

Design

An exploratory cross-sectional design was used in the current study.

Participants and Setting

This study was a population study inviting students (N = 369) in their last semester at the 8 entry-level physical therapist programs in Sweden, to participate. The response rate was 41%, with 151 students participating. Forty percent of the participating students were attending a program with behavioral medicine content and competencies formalized in the curriculum (response rate = 62%), and 60% attended a program without behavioral medicine content and competencies formalized in the curriculum (response rate = 33%). A flow diagram of participants is shown in the Figure, and demographic characteristics are shown in Table 1.

In Sweden, the duration of the entry-level physical therapist programs is 3 years (180 European Credits Transfer System scores) and leads to a bachelor degree. Entry qualification is a minimum of 13 years of schooling (elementary school and senior high school).⁴⁵ Most students are between 20 and 30 years of age,⁴⁶ implying that many students have previous work or study experiences. After graduation from an accredited university program, students can apply for a license to practice physical therapy.⁴⁵

Assessment

The web-based Reasoning 4 Change (R4C) instrument^{32,33} was used to assess the independent (except curriculum orientation) and dependent variables. The R4C instrument consists of 4 domains: domain 1 = physical therapist, domain 2 = IC, domain 3 = FBA, and domain 4 = SBC. Domain 1 includes 5 subscales where the students rate their knowledge (domain 1.1), cognition (domain 1.2), metacognition (domain 1.3), the influences of psychological factors related to attitudes and self-efficacy (domain 1.4), and contextual factors (domain 1.5) on their clinical reasoning. The items of the subscales in domain 1 consist of statements that the student assesses on 6- or 11-point Likert scales. Domains 2, 3, and 4 consist of written case scenarios which are gradually extended with new information. These assess the students' ability to identify, prioritize, analyze, and interpret key features in the management of the case. The response scales comprise written answers, Likert scales and lists of options. The scoring key of the R4C instrument is based on the response distribution provided by an expert panel of physical therapists.³³ The response options of each item are assigned a credit corresponding to the proportion of experts who selected that option. Total scores are generated for each subscale and domain separately. A detailed description of the R4C instrument has been published previously.^{32,33} The R4C instrument has demonstrated excellent content validity,³² acceptable construct validity in terms of convergent validity,³³ and satisfactory reliability in terms of interrater reliability, internal consistency, and test-retest reliability.³³

Independent variables. Knowledge: Perceived knowledge in clinical reasoning focused on behavior change was assessed with domain 1.1. The Cronbach α for the current sample was 0.76.

Cognition: Perceived cognitive capabilities and skills in clinical reasoning focused on behavior change were assessed with domain 1.2. The Cronbach α for the current sample was 0.88.

Metacognition: Perceived metacognitive capabilities and skills in clinical reasoning focused on behavior change were assessed with domain 1.3. The Cronbach α for the current sample was 0.83.

Psychological factors, attitudes: Attitudes toward a behavioral approach in clinical reasoning were assessed with domain 1.4. The Cronbach α for the current sample was 0.84.

Psychological factors, self-efficacy: Perceived self-efficacy in applying a behavioral approach in clinical reasoning was assessed with domain 1.4. The Cronbach α for the current sample was 0.89.

Contextual factors: Perceived influences from the physical and social environments of the clinical setting on applying a behavioral approach in clinical reasoning were assessed with domain 1.5. The Cronbach α for the current sample was 0.82.

Curriculum orientation: A dichotomous variable consisting of either physical therapist entry-level programs incorporating content related to behavioral medicine competencies throughout the curriculum or programs without such content. The curriculum orientation of the programs was determined by examining their curricula. In this study, a curriculum with behavioral medicine competencies was defined as one in which a behavioral medicine approach was emphasized in the purpose of the program, and behavioral medicine and associated competencies were identified as discrete core content. Furthermore, the interaction between peoples' daily life behaviors and biopsychosocial factors was emphasized, and movement and function were conceptualized as behaviors. A curriculum without behavioral medicine competencies was categorized as such based on the absence of the aforementioned features, and movement and function were described from a biopsychosocial perspective, but not conceptualized as behaviors. In case of doubt, the program directors were contacted. Two physical therapist programs were identified as having curricula with behavioral medicine competencies.

Dependent variables. Input from client in the clinical reasoning process: The student's ability to identify the client's problem and prioritized activity-related target behavior and collect relevant data associated with physical, psychological, and contextual factors through interview, observation, physical examination, and self-monitoring was assessed with domain 2.

Functional behavioral analysis in the clinical reasoning process: The student's ability to identify important, controllable, causal functional relationships among physical, psychological and contextual factors, and behavioral responses believed to affect the activity-related target behavior and express the outcome of the analyses as hypotheses was assessed with domain 3.

Strategies for behavior change in the clinical reasoning process: The student's ability to individualize and evaluate SBC based on a FBA was assessed with domain 4.

Procedure

The primary investigator (M.E.) and the program directors made a plan for the data collection. Written consent was obtained from the program directors and participants. M.E. provided the students with verbal and written information about the study and invited them to participate. The verbal information was given either face-to-face, via a video shown by an educator, or provided via a web link at the university's web platform as well as the students' e-mail and social media, such as Facebook. Data collection took place at the students' universities with the primary investigator present. A personal identification code and a private password-secured log-in for the R4C instrument were provided only to participating students; they were informed to respond as honestly as possible. They were reminded their responses were confidential, with only the primary investigator having access to them. The

students completed the R4C instrument on a computer or tablet and answered a questionnaire regarding demographic data.

Data Analysis

The statistical analyses were computed using the IBM SPSS Statistics for Macintosh, version 24.0 (IBM Corp, Armonk, NY, USA). A liberal P value ($<.10$) was regarded as significant because of the exploratory approach and the relatively small sample.

Descriptive statistics for the demographic variables and the independent and dependent variables were calculated. The bivariate relationships among the variables were calculated with the Pearson product-moment correlation.

Three hierarchical multiple regression analyses were conducted, 1 for each dependent variable. The analyses were performed by modeling the variables in 3 blocks, which were entered stepwise into the regression model. The decision about the hierarchical order of the independent variables was based on a theoretical rationale and previous research.^{41,42} According to the model of CRBC-PT,¹⁹ knowledge, cognitive and metacognitive capabilities and skills are central factors in clinical reasoning. As students' knowledge, capabilities, and skills are based mainly on their education, the curriculum orientation was regarded as a primary independent variable, thus entered first in the model. The second step was a block of the variables knowledge, cognition, and metacognition. The third step comprised psychological and contextual factors that may influence the reasoning process. Only independent variables that correlated with respective dependent variables were included in the regression analysis.

To detect possible multicollinearity among the independent variables, bivariate correlation coefficients, tolerance values, and variance inflation factors were calculated.^{42,47} The analyses showed no indications of multicollinearity.

Results

Descriptive Statistics and Bivariate Correlations

Descriptive statistics for the independent and dependent variables appear in Table 2. The bivariate correlations among the variables are shown in Table 3. Contextual factors did not correlate with any of the 3 dependent variables, thus were excluded in the regression analysis.

Regression Analyses

Regression analysis of input from client. As Tables 4 and 5 show, the entire regression model was statistically significant and explained 37% ($R^2 = 0.39$; adjusted $R^2 = 0.37$; $P < .001$) of the variance in IC. The curriculum orientation in step 1 explained 3% (change in $R^2 = 0.03$; $P = .04$) of the total variance. Higher scores in IC were reported by students attending a program with a curriculum including behavioral medicine competencies. In step 2, 22% (change in $R^2 = 0.22$; $P < .001$) of the explained variance was added by the block of knowledge, cognition, and metacognition, but knowledge was not a significant contributor to the model. When the 2 psychological variables (attitudes and self-efficacy) were entered in the third step, the explained variance increased an additional 15% (change in $R^2 = 0.15$; $P < .001$). However, self-efficacy did not significantly contribute to the model. Higher self-rated cognition, metacognition, and positive attitudes were associated with higher scores in IC.

Regression analysis of functional behavioral analysis. Tables 4 and 5 show the regression model with FBA as the dependent variable. The whole model was statistically significant and explained 4% of the variance ($R^2 = 0.07$; adjusted $R^2 = 0.04$; $P = .04$). The curriculum orientation alone explained 4% (change in $R^2 = 0.04$; $P = .01$) of the variance in FBA. Higher scores in FBA were reported by students attending a program with a curriculum including behavioral medicine competencies. The variables knowledge and cognition, included in the second step of the model, added 2% of variance, but the change was not significant. Psychological factors (self-efficacy) entered into the third step, did not add any significant proportion of the explained variance.

Regression analysis of strategies for behavior change. Tables 4 and 5 show that the entire regression model was statistically significant and explained 4% of the variance ($R^2 = 0.06$; adjusted $R^2 = 0.04$; $P = .03$) in SBC. The curriculum orientation was the only independent variable associated with the students' clinical reasoning skills at the SBC level (change in $R^2 = 0.05$; $P = .01$). Higher scores in SBC were reported by students attending a program with a curriculum including behavioral medicine competencies. The variables entered into steps 2 and 3 did not explain the variance further.

Discussion

The objective of this study was to explore the associations among the independent variables: knowledge, cognition, metacognition, psychological factors, contextual factors, and curriculum orientation vis-à-vis behavioral medicine competencies; and the dependent variables: outcomes of IC, FBA, and SBC as levels in physical therapist students' clinical reasoning processes. The key findings of our study showed that physical therapist students' cognitive and metacognitive capabilities and skills and attitudes were predictors of the students' skills in clinical reasoning focused on clients' behavior change at the IC level. Curriculum orientation (ie, included content related to behavioral medicine competencies or not) was the only predictor of the students' clinical reasoning outcomes at all 3 levels: IC, FBA, and SBC. Attending a program with a curriculum including behavioral medicine competencies was associated with better skills in clinical reasoning focused on behavior change. The results of the regression model showed appreciable unexplained variance, suggesting other variables, yet unidentified, also contribute to clinical reasoning outcomes.

One key finding was that cognition and metacognition accounted for most of the explained variance at the IC level. This suggests that students' perceptions of their cognitive capabilities and skills, for example, to interpret clients' narratives and examination findings related to target behaviors, predict the outcome of their initial clinical reasoning process. Also, the students' perceptions of their metacognitive capabilities and skills, for example, to reflect and act on, predict their clinical reasoning outcome. The use of reflection has been reported to be a key element in students' clinical reasoning to modify clinical decisions and refine future actions or thought processes,¹⁰ which confirms our findings. Furthermore, positive attitudes toward a behavioral approach in clinical reasoning predicted superior outcomes at the IC level. People's attitudes may form as a result of experience and its consequences as well as by social influences.⁴⁸ In the educational context, social influences may arise from peers, educators, and clinical instructors. Thus, clarifying expectations from others, thus enabling students to experience success in their clinical reasoning, could serve as strategies to promote positive attitudes towards a behavioral approach. In turn, such attitudes may support a biopsychosocial and behavioral perspective, important for a well-grounded start of the reasoning process. It is likely that the unexplained variance of the IC outcome illustrates the complexity of potential components that are factoring into clinical reasoning.³⁹ Communication skills,^{43,49} practical experience,^{18,35} and specific

contextual circumstances^{15,34,35} are, among others, factors that can be further studied, for example with the use of monitoring, to understand the predictors of the IC outcome overall.

Although the regression models explained a substantial proportion of the variation at the IC level, only small proportions of the variation at the FBA and SBC levels were explained by the model. This variability may be linked to imbalance in teaching and learning the various levels of clinical reasoning. The results indicate that the entry-level education emphasizes providing students with skills in collecting, interpreting, and reflecting upon information provided by the client and the physical examination. However, there seems to be less emphasis on synthesizing and analyzing this information, ie, the second level, and the selection of intervention strategies to support behavior change, ie, the third level. According to the responses on one of the items in the R4C instrument, 60% of the students seldom (half of the time or less) generated hypotheses based on a FBA and 40% mostly did. Similarly, Fritz et al²³ demonstrated that physical therapists seldom used FBAs and only a few behavior change strategies in client practice, even though they were taught a behavioral medicine approach. Also, Gilliland and Wainwright¹¹ reported that physical therapist students' reasoning strategies were 3 times as often related to the initial part of the reasoning process as to the latter part, which is consistent with our findings. Of note was that the generation of hypotheses was not an independent variable as the item was included in the subscale of cognition. Thus, no conclusions about the association between practice per se and clinical reasoning outcomes could be drawn.

Rich and discipline-specific knowledge is often described as the foundation of effective clinical reasoning,⁴ implying that a change in knowledge should result in a change in clinical reasoning. However, the regression analyses demonstrated no associations between knowledge and outcomes. Studies have shown that adaptation and application of knowledge are more fundamental for effective clinical reasoning than the amount of a particular kind of knowledge.^{15,16,50} Thus, the scope of what students know is insufficient for predicting their clinical reasoning outcomes. Instead, knowledge could be viewed as a prerequisite for more advanced cognitive activities. The relatively strong bivariate associations between knowledge and cognition in the current study support such explanations.

Goals and content of the curriculum were shown to be a predictor of the students' clinical reasoning. This finding highlights the importance of the curricula orientation to optimize clinical reasoning outcomes and foster competent physical therapists. Similarly, Gilliland and Wainwright¹¹ reported that differences among physical therapist programs might contribute to differences in students' clinical reasoning. Variations in patterns of reasoning and students' approaches to a client's problem were evident among students from various universities. Conversely, Baybar et al⁵¹ did not find that curriculum design directly influenced clinical reasoning development in final-year students. Rather, the students emphasized influences from the academic and clinical settings as well as personal experiences. These 2 studies are based on qualitative data, and no analysis of regression had been conducted, which must be considered when comparing their findings. Based on the current study, it is most likely that curricula orientation impacts teaching, in turn affects students' clinical reasoning mastery. Thus, clinical reasoning can be viewed as a fundamental outcome of the professional entry level education process.

A primary goal for entry-level physical therapist education is to prepare graduates for current, and future health demands,² particularly where unhealthy lifestyle-related behaviors and their associated diseases constitute major public health challenges.⁵² To manage these demands effectively, clinicians and students need to expand their skill set by incorporating psychosocial and behavioral competencies in clinical reasoning.^{5,6,11,22,25} Comparisons of the students' scores in the present study with the criterion scores of R4C (generated by experts)³³ reveal that the students scored lower on the predictors and outcome variables. This "student-expert gap" shows room for improvement in students' skills in integrating behavioral competencies into their clinical reasoning. Curricular design has a key

role to play in reducing this gap and providing students with capabilities and skills to manage lifestyle-related behaviors to improve health and reduce disease risk in their clients. However, curriculum orientation explained a significant but limited proportion of the variance in the clinical reasoning outcomes; thus, other predictors need to be explored.

Strengths and Limitations

A methodological strength of the current study was the selection of independent variables based on theory, ie, the model of CRBC-PT, and previous research, ie, qualitative studies and systematic reviews, which is consistent with current recommendations.^{41,42} The ratio of participants to independent variables must be substantial for testing multiple correlations. Tabachnick and Fidell⁴¹ have presented a rule of thumb for sample sizes of $N \geq 50 + 8m$ (m = number of independent variables). Accordingly, a sample of 151 students with 7 independent variables was appropriate.

Even though the representativeness of students varied among the programs, students from all 8 Swedish universities participated. Such large, multisite studies have been advocated to improve education research in physical therapy⁴⁰; thus, the design of a population study is considered a strength. The current study's sample consisted of 65% women and 35% men, with an age distribution of 59% ≤ 24 years, 38% 25 to 34 years, and 3% ≥ 35 years; in comparison, the national population of graduated students (year 2017) was 66% women and 34% men, with an age distribution of 41%, 52%, and 7%, respectively.⁴⁶ Thus, the current sample was slightly younger than the population but consistent according to sex which strengthens the generalizability of the results.

There are some limitations of this study. First, no causal relationships can be inferred given the cross-sectional design selected. Second, the physical therapist students' clinical reasoning refers to their ability to integrate clients' activity-related behavior and behavior change into their clinical reasoning but not clinical reasoning ability overall or with other foci. Third, the results pertaining to 6 of the predictors may be limited given the use of students' self-assessments. There are doubts about an individual's capacity to assess one's professional strengths and weaknesses accurately⁵³ and there may be risk of social desirability bias.⁵⁴ However, the students' ratings reflected self-awareness since their scores differed from experts' scores. Fourth, less than half of the final-year students participated in the study, which is further a limitation. The problem of recruiting students and their response rates has been reported in other studies as well. Response rates of 3% and 22% have been reported in large surveys with final-year physical therapist students from Europe⁵⁵ and the United States,⁵¹ respectively. Fifth, there may have been a risk of sample bias because of the low response rate of students attending a program with a curriculum without behavioral medicine competencies, which may have influenced the findings. However, the sample size of the responding students was large, which enabled that the responses of the sample reflected the group of students attending a program without behavioral medicine competencies rather well. In conclusion, the external validity of the current study was somewhat weakened by the moderate response rate but strengthened by student participation across eligible universities and by correspondence of the age and sex distribution of the sample with the population.

Using a web-based instrument to assess clinical reasoning also has strengths and limitations. On the one hand, assessment of cognitive processes is facilitated by well-designed instruments.^{56,57} Also, web-based instruments have the advantages of preventing internal loss of data and being time-efficient and easy to administer, which enables large studies. On the other hand, essential interactive and contextual dimensions of clinical reasoning are challenging to assess with instruments.^{12,58} To support the interactive and contextual dimensions, the R4C instrument includes informed design elements, such as continuous addition of new client information, multiple acceptable reasoning paths, and the consideration of context-specificity,^{56,58} which is a strength. Based on the assessment with

R4C, the conclusions of the current study are related to clinical reasoning skills, whereas conclusions about clinical reasoning competence in clinical practice are limited.

Implications

The demonstrated links between individual- and curriculum-level factors and physical therapist students' abilities to focus on behavior change in their clinical reasoning provide incentives to further develop clinical reasoning competencies in physical therapists. Professional associations and stakeholders should address the necessity of theoretical and skills-based components in a holistic and behavioral approach throughout physical therapist entry-level education programs. Universities are encouraged to review the entry-level curricula to emphasize equally the levels of the clinical reasoning process. Furthermore, educators need to emphasize students' analytical and reflective capabilities and skills rather than primarily factual knowledge. It is also essential to create an educational context in which positive attitudes toward a behavioral approach in clinical reasoning are supported. For students, the findings could increase their awareness about individual influencing factors and thus support their self-regulation in learning clinical reasoning.

Future studies are needed to deepen our understanding of how specific educational factors, such as the extent of practical experiences in clinical reasoning focused on behavior change, are associated with students' clinical reasoning outcomes. Furthermore, educational interventions targeting the FBA and SBC levels are warranted to understand better what improves outcomes of clinical reasoning across its levels.

Conclusions

Cognitive and metacognitive capabilities and skills and positive attitudes are key predictors of the outcome of the first level of physical therapist students' clinical reasoning focused on behavior change and should be targeted to improve clinical reasoning effectiveness. Education founded on a curriculum with behavioral medicine competencies is associated with positive outcomes of students' clinical reasoning focused on behavior change at all levels of the reasoning process, which should be considered in curricula development. Given the included predictors did not explain a substantial amount of the variance in the clinical reasoning outcomes, further research is warranted.

Author Contributions and Acknowledgments

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Ethics Approval

This study was part of a larger project reviewed by the Regional Ethical Review Board, Uppsala, Sweden and met the ethical requirements consistent with Swedish law (SFS 2003:460) and the Declaration of Helsinki regarding human research (Dnr 2013/020). Written consent was obtained from the program directors and participants.

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Disclosure and Presentations

The authors completed the ICJME Form for Disclosure of Potential Conflicts of Interest and reported no conflicts of interest.

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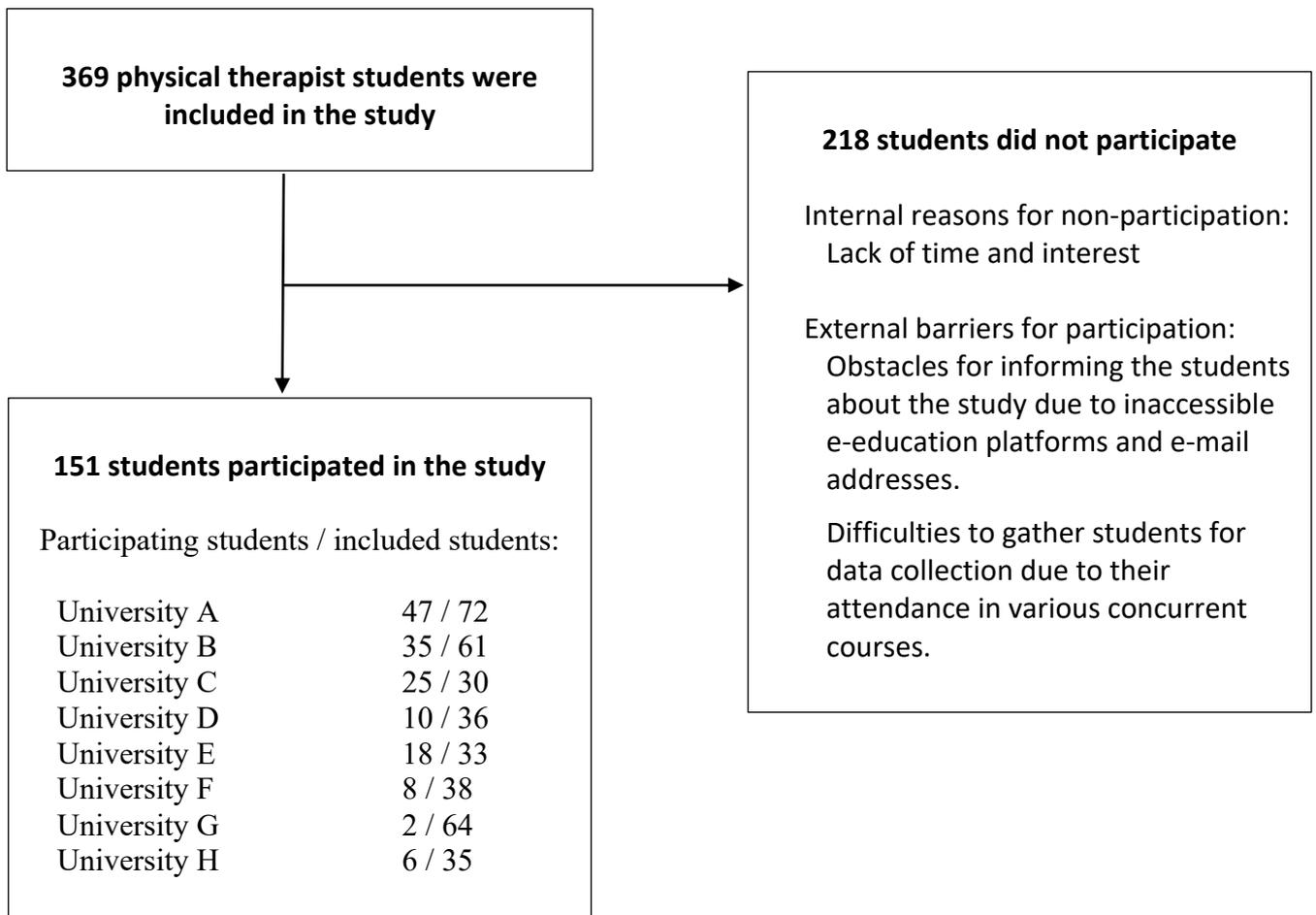


Figure 1. Flow diagram of participants within the study.

Table 1. Demographic Characteristics of the 151 Physical Therapist Students

Characteristic	No.	%
Sex		
Women	98	65
Men	53	35
Age (y) ^a		
22–24	89	59
25–29	48	32
30–34	9	6
35–41	5	3
Curriculum orientation		
With behavioral medicine competencies	61	40
Without behavioral medicine competencies	90	60
Work experience in the area of health and welfare		
Yes	107	71
No	44	29
Work experience in other areas		
Yes	136	90
No	15	10
Ongoing clinical placement in the physical therapist program		
Yes	17	11
No	134	89
Studies other than physical therapy (credits ^b)		
No	82	54
>0–7.5	21	14
>7.5–30	22	14
>30–120	19	13
>120	7	5
Previous study break during education		
Yes	10	7
No	141	93
Experience of teaching peers		
Yes	16	11
No	135	89

^aThe mean age was 25 y, and the SD was 3.6 y.

^b1.5 credits correspond to 1 wk of full-time studies.

Table 2. Scores of All Included Variables (Except Curriculum Orientation) for the 151 Physical Therapist Students^a

Variable	Theoretical Minimum–Maximum Total Scores^a	Mean (SD)	Median (Quartile 1–Quartile 3)	Observed Minimum–Maximum Scores
Independent				
Knowledge	8–48	33.8 (4.9)	34.0 (30.0–38.0)	19–45
Cognition	7–46	32.3 (6.0)	33.0 (28.0–36.0)	19–44
Metacognition	8–48	38.0 (5.4)	38.0 (34.0–42.0)	23–48
Psychological factors, attitudes	0–100	80.7 (10.0)	81.0 (75.0–88.0)	56–100
Psychological factors, self-efficacy	0–100	67.0 (12.2)	68.0 (60.0–74.0)	31–93
Contextual factors	5–30	18.0 (5.2)	18.0 (14.0–22.0)	7–29
Dependent				
Input from client	0.6–66.1	37.1 (6.4)	36.7 (31.9–41.3)	23.4–53.9
Functional behavioral analysis	3.8–34.3	23.1 (2.7)	23.2 (21.3–24.9)	15.1–30.0
Strategies for behavior change	0–36.4	18.7 (3.5)	18.7 (16.1–21.1)	9.0–26.6

^aHigher scores indicate superior skills

Table 3. Correlations Between Variables

Variable	Input From Client	Functional Behavioral Analysis	Strategies for Behavior Change	Curriculum Orientation	Knowledge	Cognition	Meta-cognition	Psychological Factors, Attitudes	Psychological Factors, Self-Efficacy	Contextual Factors
Dependent										
Input from client										
Functional behavioral analysis	0.19 ^{a,b}									
Strategies for behavior change	0.21 ^{a,c}	0.28 ^{a,d}								
Independent										
Curriculum orientation	0.1 ^{b,e}	0.20 ^{c,e}	0.23 ^{c,e}							
Knowledge	0.19 ^{b,e}	0.17 ^{b,e}	0.03 ^e	0.31 ^{a,d}						
Cognition	0.36 ^{d,e}	0.21 ^{c,e}	0.16 ^{b,e}	0.3 ^{a,d}	0.72 ^{a,d}					
Metacognition	0.40 ^{d,e}	0.02 ^e	0.02 ^e	-0.09 ^a	0.24 ^{a,b}	0.34 ^{a,d}				
Psychological factors, attitudes	0.56 ^{d,e}	0.01 ^e	0.08 ^e	-0.02 ^a	0.17 ^{a,b}	0.30 ^{a,d}	0.51 ^{a,d}			
Psychological factors, self-efficacy	0.27 ^{d,e}	0.11 ^{e,f}	0.12 ^{e,f}	0.23 ^{a,c}	0.60 ^{a,d}	0.65 ^{a,d}	0.33 ^{a,d}			
Contextual factors	0.04 ^e	-0.01 ^e	-0.10 ^e	-0.50 ^{a,d}	0.0 ^a	0.02 ^a	0.17 ^{a,b}	0.21 ^{a,c}	0.11 ^a	

^a2-tailed.

^b $P < .05$.

^c $P < .01$.

^d $P < .001$.

^e1-tailed.

^f $P < .10$.

Table 4. Hierarchical Regression Analyses for Input From Client, Functional Behavioral Analysis, and Strategies for Behavior Change^a

Parameter	Step 1			Step 2			Step 3			
	B (95% CI)	SE for B	P	B (95% CI)	SE for B	P	B (95% CI)	SE for B	P	
Input from client										
Step 1										
Curriculum orientation ^b	2.22 (0.14 to 4.31)	1.06	.04	1.89 (-0.16 to 3.94)	1.04	.07	2.02 (0.17 to 3.87)	0.94	.03	.03
Step 2										
Knowledge				-0.22 (-0.49 to 0.05)	0.14	NS	-0.14 (-0.39 to 0.11)	0.13	NS	NS
Cognition				0.34 (0.11 to 0.57)	0.12	.01	0.26 (0.03 to 0.48)	0.11	0.24	.03
Metacognition				0.41 (0.23 to 0.59)	0.09	<.001	0.17 (-0.01 to 0.36)	0.09	0.15	.07
Step 3										
Psychological factors, attitudes							0.29 (0.19 to 0.39)	0.05	0.46	<.001
Psychological factors, self-efficacy							-0.03 (-0.13 to 0.06)	0.05	-0.60	NS
Functional behavioral analysis										
Step 1										
Curriculum orientation ^b	1.13 (0.25 to 2.02)	0.45	.01	0.82 (-0.12 to 1.76)	0.48	.09	0.82 (-0.12 to 1.76)	0.48	0.15	.09
Step 2										
Knowledge				0.02 (-0.11 to 0.14)	0.06	NS	0.02 (-0.11 to 0.15)	0.07	0.04	NS
Cognition				0.06 (-0.04 to 0.17)	0.05	NS	0.07 (-0.04 to 0.19)	0.06	0.16	NS
Step 3										
Psychological factors, self-efficacy							-0.01 (-0.060 to .04)	0.02	-0.047	NS

(Continued on the next page)

(Table 4 continued)

Parameter	Step 1			Step 2			Step 3					
	B (95% CI)	SE for B	β	P	B (95% CI)	SE for B	β	P	B (95% CI)	SE for B	β	P
Strategies for behavior change												
Step 1												
Curriculum orientation ^b	1.63 (0.48 to 2.75)	0.58	0.22	.01	1.39 (0.18 to 2.60)	0.61	0.19	.03	1.39 (0.18 to 2.60)	0.61	0.19	.03
Step 2												
Cognition					0.05 (-0.05 to 0.15)	0.05	0.09	NS	0.04 (-0.09 to 0.17)	0.04	0.07	NS
Step 3												
Psychological factors, self-efficacy									0.01 (-0.05 to 0.07)	0.03	0.03	NS

^aB = nonstandardized regression coefficient; β = standardized beta coefficient; NS = not significant.

^bStudents attending a program that had a curriculum with behavioral medicine competencies were coded as 1, and students attending a program that had a curriculum without behavioral medicine competencies were coded as 0.

Table 5.
Model Summaries of the Hierarchical Regression Analyses^a

Model	<i>F</i> (<i>P</i>)	<i>df</i>	<i>R</i>²	Adjusted <i>R</i>²	Change in <i>R</i>² (<i>P</i>)
Input from client					
Step 1	4.43 (.04)	1, 149	0.03	0.02	0.03 (.04)
Step 2	11.93 (<.001)	4, 146	0.25	0.23	0.22 (<.001)
Step 3	15.52 (<.001)	6, 144	0.39	0.37	0.15 (<.001)
Functional behavioral analysis					
Step 1	6.45 (.01)	1, 149	0.04	0.04	0.04 (.01)
Step 2	3.31 (.02)	3, 147	0.06	0.04	0.02 (NS)
Step 3	2.52 (.04)	4, 146	0.07	0.04	0.001 (NS)
Strategies for behavior change					
Step 1	7.91 (.01)	1, 149	0.05	0.04	0.05 (.01)
Step 2	4.53 (.01)	2, 148	0.06	0.05	0.01 (NS)
Step 3	3.03 (.03)	3, 147	0.06	0.04	0.001 (NS)

^aNS = not significant.