# Mismatch between the proposed ability concepts of the Graduate Record Examination and the critical thinking skills of physical therapy applicants suggested by an expert panel in the United States

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**Purpose:** The Graduate Record Examination (GRE) is a general examination predictive of success in US-based graduate programs. Used to assess students' written, mathematical, and critical thinking (CT) skills, the GRE is utilized for admission to approximately 85% of US physical therapist education (PTE) programs. The purpose of this study was to assess whether the CT skills measured by the GRE match those deemed by an expert panel as the most important to assess for PTE program acceptance.

**Methods:** Using a modified E-Delphi approach, a 3-phase survey was distributed over 8 weeks to a panel consisting of licensed US physical therapists with expertise on CT and PTE program directors. The CT skills isolated by the expert panel, based on Facione's Delphi Report, were compared to the CT skills assessed by the GRE.

**Results:** The CT skills supported by the Delphi Report and chosen by the expert panel for assessment prior to acceptance into US PTE programs included clarifying meaning, categorization, and analyzing arguments. Only clarifying meaning matched the CT skills from the GRE.

**Conclusion:** The GRE is a test for general admission to graduate programs, lacking context related to healthcare or physical therapy. The current study fails to support the GRE as an assessment tool of CT for admission to PTE programs. A context-based admission test evaluating the CT skills identified in this study should be developed for use in the admission process to predict which students will complete US PTE programs and pass the licensure exam.

**Keywords:** Physical therapist education; Graduate Records Examination; Critical thinking; Delphi technique; United States

## Introduction

The Delphi Report defines critical thinking (CT) as the "purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation and inference." The individual processes of in-terpretation, analysis, evaluation, and inference are the CT skills used to make a decision [1]. In the United States, the 2015 accreditation standards of the Commission on Accreditation of Physical Therapy Education emphasize CT skills in accredited education programs [2]. To educate healthcare providers effectively, professional academic programs must teach psychomotor skills and techniques utilized in treating those who have medical conditions, as well as the clinical reasoning skills needed to make decisions using CT [3].

The Graduate Record Examination (GRE) General Test, which

assesses verbal, qualitative, and analytical factors including CT, is used as an admissions requirement by approximately 85% of physical therapist education (PTE) programs [4]. It is generally used for admission to graduate or business school because it is indicative of success in these types of graduate programs. The aim of this study was to assess whether the Delphi Report's CT skills that were identified by an expert panel as absolutely essential for assessment before entrance into PTE programs in the United States matched those contained in the GRE, a common PTE admission requirement.

## Methods

### Ethics statement

The research was approved by the Institutional Review Board of University of Tennessee Health Science Center (#16-05037-XP

UM). Informed consent was obtained from participants.

### Conceptual framework

With a mixed-methods approach, containing both qualitative and quantitative research methods, the Delphi method used in this study allows a group's individual opinions, which may change based on feedback, to stand as a solitary opinion. The social group for this study was US licensed physical therapists, and the worldview was their perceptions of CT [5]. The current study was bounded by the Delphi Report's definitions of skills and sub-skills of CT [1]. These are found in Table 1.

### Setting

Since the intent of this study was to find a consensus, the modified E-Delphi method using a Qualtrics survey was the process undertaken for this study [6]. The modified E-Delphi method

**Table 1.** Critical thinking skills and sub-skills as defined by the Delphi Report [11]

| Critical thinking skills | Critical thinking skills defined | Subskills | Subskills defined |
|---|---|---|---|
| Interpretation | The ability to understand and convey the significance of an experience | Categorization | Occurs when experiences or beliefs are framed for understanding |
| | | Decoding significance | A situation or experience is described in relation to affective attitudes or motives behind the situation |
| | | Clarifying meaning | Restating or paraphrasing the situation or experience in different terms to remove any ambiguity or confusion |
| Analysis | Concepts or situations are examined, and relationships are identified | Examining ideals | Ideals are compared and contrasted, and problems with the ideals are identified and broken down |
| | | Detecting arguments | Determining whether an idea or situation involves reasons to support or refute the idea |
| | | Analyzing arguments | A complex process where the conclusion, the reasons for the conclusion, support for those reasons and their structure, other outcomes, and outliers are identified and accepted or rejected |
| Evaluation | Deciding whether a person or their statements are credible or finding that relationships are logical | Assessing claims | Recognizing factors that make the source of information credible |
| | | Assessing arguments | Judging whether an argument is plausible or false |
| Self-regulation | The metacognitive activity of assessing one's analysis, judgements, and evaluation | Self-examination | Looking at the reasoning used, and opinions created, as well as the "motivation, values, attitudes and interests" that determine the outcome |
| | | Self-correction | Occurs when self-examination shows an error in the decision or reason, and allows for correction of this mistake |
| Explanation | The results of reasoning are stated and justified based on the evidence examined to reach a decision | Stating results | Giving accurate statements |
| | | Justifying procedures | Presenting the evidence behind the decision |
| | | Presenting arguments | Giving a rationale for accepting an assertion |
| Inference | Components are assembled for a hypothesis, then considered, and a conclusion is made | Querying evidence | Occurs when additional supporting information is needed to develop or reinforce an argument and how to find that additional supporting information |
| | | Conjecturing alternatives | Creating other alternative ways to ask a question, multiple ways to resolve an issue or project consequences |
| | | Drawing conclusions | Ensues when hypotheses are tested or opinions are compared to determine what to do or believe |

uses an internet-based survey to replace paper, pencil, and postage [7]. Because no previous study has assessed these variables in PTE, a survey was developed to gather this information. The survey was pilot-tested for construct validity, ensuring that it measured what it was designed to measure [8]. Face validity was established by having a faculty colleague at the University of Tennessee who has published in the realm of CT, but is not a physical therapist, assess the survey. In this capacity, colleagues are able to inform the researcher if "the items look OK to them" [8]. Changes to the initial survey were made based on this feedback such as clarifying instrument instructions so that participants would know to rank each skills individually versus ranking skills against each other and adding a progress bar to the survey. A final pilot test was sent to a group of 16 healthcare faculty members at the local health science university where the primary researcher is employed. Over a 4-week period, the 3 rounds of the modified E-Delphi survey were completed. The last pilot test was used to establish the criterion percentage of agreement that was used in the current study (Fig. 1).

## Instrument

An introductory letter was sent via email to all of the experts, disclosing the intent, significance, and methods of the study as well as operational definitions pertaining to the study. In the introductory email, a secure hyperlink to the online research survey was included. If participants clicked the hyperlink, an informed consent document was the first item they were required to complete. The consent document included the purpose of the research, how the participants were selected, the risk involved, and assurance that the participant could withdraw at any time (Appendix 1). The survey platform Qualtrics (https://www.qualtrics.com) was used.

## Sample and expert panel

A purposive sample of 246 US physical therapists was invited to participate in this study as the expert panel. The experts in this study were defined as published physical therapists in the realm of CT (n = 19) and PTE program directors (n = 227). Program directors were selected because they are considered to be experts in PTE who have insider knowledge of what CT skills need to be in place prior to admission. Physical therapists who have published
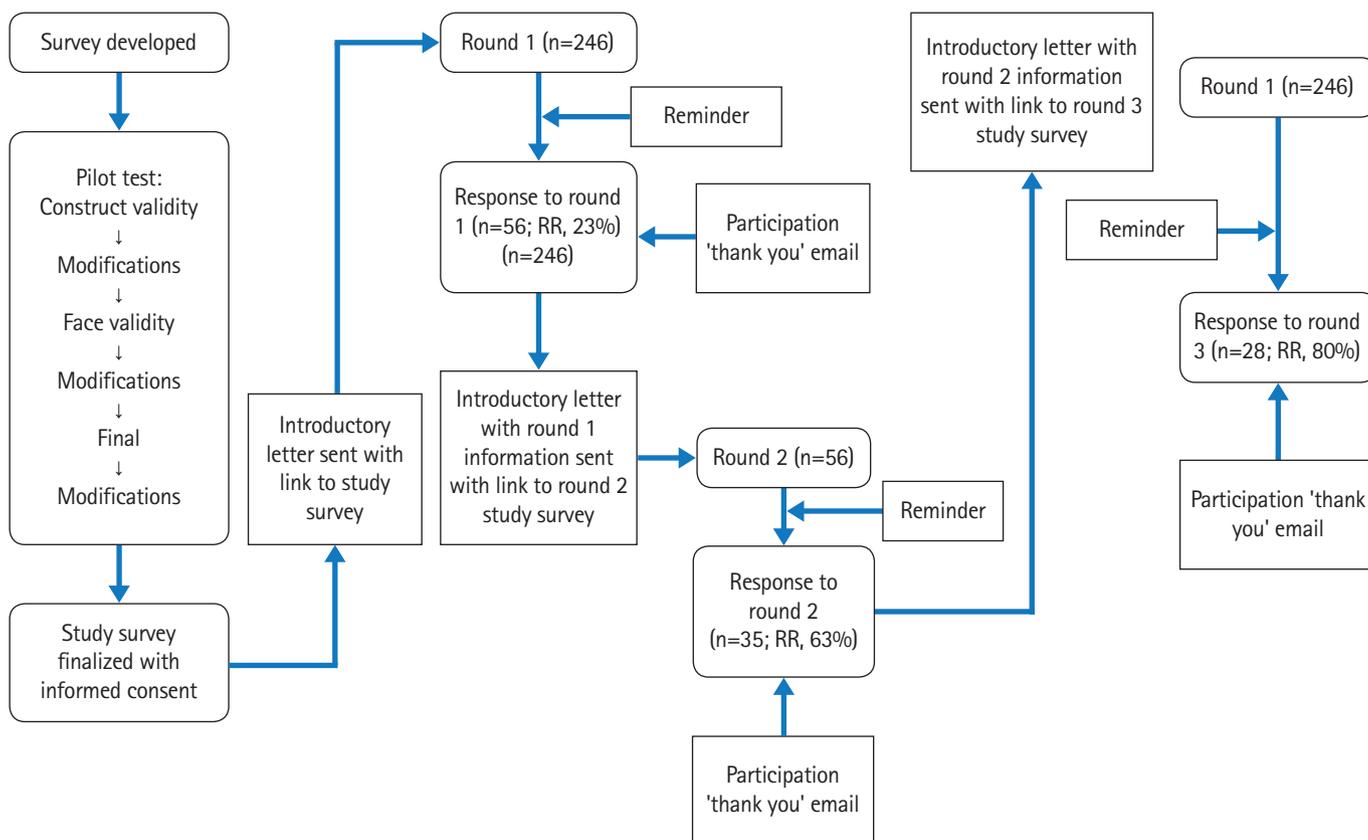


**Fig. 1.** Methods flowchart. RR, response rate percentage.

in the realm of CT have demonstrated that they have knowledge and expertise in CT, which increased their likelihood of completing the Delphi process [9]. The following inclusion criteria were used: US-licensed physical therapists who had publications on CT in the last 20 years; otherwise, US-licensed program directors of accredited PTE programs. Opting out of the informed consent or the survey process or failing to complete the survey excluded participants from the study.

Fifty-six physical therapists completed the entire first round of the study, yielding a 23% response rate. The second survey for round 2 was sent to the 56 participants from round 1. Thirty-five participants completed round 2 of the survey, for a response rate of 63%. The final survey was sent to the 35 panel members who completed round 2. With a response rate of 80%, 28 panel members completed the final round of this survey. The classification of participants is outlined in Table 2.

A 3-round process was chosen for this modified E-Delphi survey because the literature suggests that surveys with more than 3 rounds can cause participant fatigue and lower the response rate [9].

In each round, the expert panel provided demographic information and answered survey questions by ranking each of the CT skills using a 5-point Likert scale. The CT skills and definitions were given because research has shown that providing definitions to the experts can significantly reduce the time invested in completing a Delphi survey and can strengthen the Delphi method [10,11]. Each expert was directed to choose the importance of a CT skill that could be assessed by an examination prior to PTE. The scores on the Likert scale were 0 = not important, 1 = little importance, 2 = average importance, 3 = very important, and 4 = absolutely essential (Appendix 1).

In the first round, a skill was retained if 90% of the panel rated a skill with a score of 2 or higher. A score of 2 represented the point where a skill or construct was seen as having average importance. The second survey was sent out and the expert panel completed a survey similar to the first round. In the second round, 75% of the experts had to choose a score of least 3 (very important) for the skill to be retained for round 3. In the last round, 75% of the ex-

perts had to give a skill or construct a score of at least 3 (very important) for this skill or construct to be viewed as significant enough for inclusion on an admission exam for PTE. Pilot-testing guided the percentage thresholds. For the first round, 90% was chosen because higher percentages would result in more skills being eliminated. Feedback from the pilot group in the first round indicated it was difficult not to consider all skills as absolutely essential. In subsequent rounds, 75% was used to retain skills since pilot-testing indicated that this percentage eliminated some, but not all skills.

## Results

Using a modified E-Delphi approach, a 3-phase survey was distributed over 8 weeks. Analysis of the data from round one eliminated 1 CT skill, analyzing arguments, with an expert panel agreement of 89%. The retained CT skills included categorization, decoding significance, clarifying meaning, examining ideals, detecting arguments, analyzing arguments, assessing claims, assessing arguments, querying evidence, conjecturing alternatives, drawing conclusions, stating results, justifying procedures, presenting arguments, self-examination, and self-correction. Stating results earned the highest agreement score of 100% (Supplement 1).

Round 2 eliminated 8 CT skills (percentage of agreement): decoding significance (63%), examining ideals (74%), detecting arguments (70%), querying the evidence (63%), conjecturing alternatives (46%), drawing conclusions (74%), justifying procedures (74%), and presenting arguments (74%). The CT skills retained in round 2 were: categorization, clarifying meaning, assessing claims, assessing arguments, stating results, self-examination, and self-correction. As in round 1, the CT skill stating results (88%) had the highest consensus rating (Supplement 1).

Categorization (62%) was the single CT skill eliminated in the last round. The CT skills retained in this final survey were clarifying meaning, assessing claims, assessing arguments, stating results, self-examination, and self-correction (Supplement 1). In total, 10 CT skills were eliminated over the 3 rounds of the modified

**Table 2.** Response rate and classification of participants

| Variable | Round 1 | Round 2 | Round 3 |
|---|---|---|---|
| No. of participants | 246 | 56 | 35 |
| Responded (response rate %) | 56 (23) | 35 (63) | 28 (80) |
| Gender (female/male) | 40/16 | 27/8 | 21/17 |
| % PD/faculty/other[a)] | 80/11/9 | 77/11/12 | 78/11/11 |
| Published CT[b)] (%) | 20 (36) | 12 (34) | 9 (32) |

PD, program directors.
[a)]Admissions committee or PD designee. [b)]Critical thinking, self–identified.

E-Delphi survey. Then, the CT skills isolated by the expert panel were compared to the CT skills assessed by the GRE. Although the GRE's CT skills show some similarity to the Delphi Report's CT skills, information on the framework used to derive the GRE CT skills was not evident in the literature. The specific skills retained or eliminated are found in Table 3.

## Discussion

The expert panel selected clarifying meaning, assessing claims, assessing arguments, stating results, self-examination, and self-correction as the most important CT skills an applicant needs when applying to a PTE program. When the results of the expert panel were compared to the GRE skills, only clarifying meaning, a sub-skill of interpretation, appeared to be assessed by the GRE and was retained by the expert panel. Clarifying meaning corresponds to the statement made by the developers of the GRE that it evaluates test-takers' ability to articulate "complex ideas clearly and effectively" [4]. Although the CT skills described by a work of Facione [1] show some similarity to the CT skills described on the GRE, further information on the framework used to derive these CT skills was not evident.

Clarifying meaning may have been a common item between the survey conducted in this study and the GRE CT skills because it is an initial step in CT. It is a useful skill for recognition of problems, as it helps paraphrase or clarify a problem. Successful mastery of this skill can allow a student to remove ambiguity or confusion in communications, in relationships, and in general experiences. For the physical therapy student, clarifying meaning is essential to clinical reasoning, as it allows the student to consider difficulties and options, raise questions, and analyze solutions to make decisions concerning a patient's health and safety [12,13].

The literature reviewed does not support clarifying meaning as important. In a study of Brudvig et al. [14] using another CT assessment, the Health Science Reasoning Test (HSRT), student physical therapists showed significant improvements in CT between entrance into the program and their third year of school. The skills of drawing conclusions, conjecturing alternatives, and querying the evidence fall under inference, and none of these skills were chosen by the expert panel as important to assess prior to entrance into PTE programs. Huhn et al. [3], also using the HSRT, assessed differences in the CT of novice (first-year students) versus expert (at least 5 years of experience and clinical specialization) physical therapists. That study found that examining ideals, detecting arguments, and analyzing arguments were significantly different in the novice and expert groups. All these skills were also eliminated by the expert group in the current study. These works assessed CT changes in established physical therapy students versus students prior to entrance into PTE. Many of the CT skills are facilitated through the actual didactic and clinical context of PTE. No literature was found that studied CT prior to start of PTE. This may explain why clarifying meaning was not found in the literature.

The skills measured on the GRE do not have a healthcare-related focus, and therefore may not show an applicant's true grasp of CT. Many applicants prepare for PTE programs by majoring in

**Table 3.** Retained or eliminated skills

| Skills | Round 1 (n = 56) | Round 2 (n = 35) | Round 3 (n = 28) | Retained |
|---|---|---|---|---|
| Categorization | 95 | 77 | 62 | x |
| Decoding significance | 95 | 63 | x | x |
| Clarifying meaning | 95 | 86 | 76 | ✓ |
| Examining ideals | 98 | 74 | x | x |
| Detecting arguments | 98 | 70 | x | x |
| Analyzing arguments | 89 | x | x | x |
| Assessing claims | 98 | 83 | 79 | ✓ |
| Assessing arguments | 96 | 77 | 79 | ✓ |
| Querying the evidence | 95 | 63 | x | x |
| Conjecturing alternatives | 95 | 46 | x | x |
| Drawing conclusions | 98 | 74 | x | x |
| Stating results | 100 | 88 | 93 | ✓ |
| Justifying procedures | 98 | 74 | x | x |
| Presenting arguments | 93 | 74 | x | x |
| Self-examination | 98 | 77 | 90 | ✓ |
| Self-correction | 95 | 86 | 79 | ✓ |

Values are presented as %. Percentages are agreement rates of the expert panel. X areas signify eliminated skills.

exercise science, kinesiology, or a science, technology, engineering, and math program and by observing or working in a physical therapy clinic. Taking an examination, void of the healthcare context in which they have submerged themselves for years, could put these applicants at a disadvantage.

In conclusion, based on the comparisons made in this study, the GRE does not include most of the skills that experts felt were needed. The context for the GRE is not specific to healthcare or physical therapy. Due to these variables and the inconsistent use in US PTE programs, the CT of applicants cannot truly be assessed by this examination. Currently, there is no pre-admission examination specific to physical therapy or one that has CT as part of its focus. However, studies have suggested that assessing CT during the admission process would be beneficial for predicting which students would be successful in PTE [15,16]. Alternative tests that could be used to assess CT include the HSRT [17], the California Critical Thinking Skills Test [17], and the Watson Glaser Critical Thinking Test [18], of which only the HSRT has a healthcare focus. Nonetheless, a partnership formed by physical therapist educators, examination developers, and physical therapist experts in CT, clinical reasoning, and clinical decision-making could use the results of this study to form the basis for the CT portion of a discipline-specific admission examination for PTE.

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## Authors' contributions

All work was done by ESH.

## Conflict of interest

No potential conflict of interest relevant to this article was reported.

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## Supplementary materials

Supplement 1. Data files are available from https://doi.org/10.7910/DVN/VRWOJF

Supplement 2. Audio recording of the abstract.

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**Appendix 1.** Delphi survey questionnaire

**Q1. Consent to Participate in a Research Study** ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮
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- **WHY ARE YOU BEING INVITED TO TAKE PART IN THIS RESEARCH?** You are being invited to take part in a research study about critical thinking and higher order constructs in the admission process to physical therapist education programs.

- **WHO IS DOING THE STUDY?** The person in charge of this study is Shannon Hughes, a doctoral student at the ▮▮▮▮▮▮▮▮▮▮ ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮. She is being guided in this research by ▮▮▮▮▮▮▮▮▮▮▮.

- **WHAT IS THE PURPOSE OF THIS STUDY?** By doing this study, we hope to learn which critical and higher order constructs should be adopted into a pre-admission exam, if such an examination is adopted for use for admission into physical therapist education programs.

- **ARE THERE REASONS WHY YOU SHOULD NOT TAKE PART IN THIS STUDY?** None

- **WHERE IS THE STUDY GOING TO TAKE PLACE AND HOW LONG WILL IT LAST?** The research procedures will be conducted at ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮ through an online Qualtrics survey. The study should last approximately two to three months.

- **WHAT WILL YOU BE ASKED TO DO?** This is the first of three surveys, where you will be asked to rank the critical thinking skill and higher order construct that you feel is the most essential to be tested prior to admission to physical therapist education programs. The internet questionnaire should take approximately ten to twenty minutes to complete. Other questions included in this initial survey will ask demographic information including gender, age, educational information, number of years as a physical therapist and number of years of interest in critical thinking and higher order constructs.

- **WHAT ARE THE POSSIBLE RISKS AND DISCOMFORTS?** None

- **WILL YOU BENEFIT FROM TAKING PART IN THIS STUDY?** You will not get any personal benefit from taking part in this study.

- **DO YOU HAVE TO TAKE PART IN THE STUDY?** If you decide to take part in the study, it should be because you really want to volunteer. You will not lose any benefits or rights you would normally have if you choose not to volunteer. You can stop at any time during the study and still keep the benefits and rights you had before volunteering.

- **IF YOU DON'T WANT TO TAKE PART IN THE STUDY, ARE THERE OTHER CHOICES?** If you do not want to be in the study, there are no other choices except not to take part in the study.

- **WHAT WILL IT COST YOU TO PARTICIPATE?** There are no costs associated with taking part in the study.

- **WILL YOU RECEIVE ANY REWARDS FOR TAKING PART IN THIS STUDY?** You will not receive any rewards or payment for taking part in the study.

- **WHO WILL SEE THE INFORMATION THAT YOU GIVE?** We will make every effort to keep private all research records that identify you to the extent allowed by law. Your information will be combined with information from other people taking part in the study. When we write about the study, we will write about the combined information we have gathered. You will not be personally identified in these written materials. We will publish the results of this study; however, we will keep your name and other identifying information private. This study is anonymous. That means that no one, other than the researcher, will know that the information you give came from you.

- **CAN YOUR TAKING PART IN THE STUDY END EARLY?** If you decide to take part in the study you still have the right to decide at any time that you no longer want to continue. You will not be treated differently if you decide to stop taking part in the study. The individuals conducting the study may need to withdraw you from the study. This may occur if you are not able to follow the directions they give you, if they find that your being in the study is more risk than benefit to you, or if the agency funding the study decides to stop the study early for a variety of scientific reasons.

- **WHAT IF YOU HAVE QUESTIONS, SUGGESTIONS, CONCERNS, OR COMPLAINTS?** Before you decide whether to accept this invitation to take part in the study, please ask any questions that might come to mind now. If you have concerns or questions about this study, please contact Shannon Hughes at ███████████████████████████████████████████████████ ████████████████████████████████████████████████████. If you have any questions about your rights as a volunteer in this research, contact the ███████████████████████████████████ ██████

- By beginning this survey, you acknowledge that you have read this information and agree to participate in this research, with the knowledge that you are free to withdraw your participation at any time without penalty.
  - ○ Yes, I AGREE to participate in this study. (1)
  - ○ No, I DO NOT agree to participate in this study. (2)

> If No, I DO NOT agree to parti... Is Selected, Then Skip To End of Survey

**Q5. How many years have you been a physical therapist?**

| | | | |
|---|---|---|---|
| ○ 0–1 years (1) | ○ 1–5 years (2) | ○ 6–10 years (3) | ○ 11–15 years (4) |
| ○ 16–20 years (5) | ○ 21–25 years (6) | ○ 26–30 years (7) | ○ > 30 years (8) |

**Q2. Gender?**

| | | |
|---|---|---|
| ○ Male (1) | ○ Female (2) | ○ Choose not to answer (3) |

**Q3. What is your age?**

| | | | |
|---|---|---|---|
| ○ Under 18 (1) | ○ 18–24 (2) | ○ 25–34 (3) | ○ 35–44 (4) |
| ○ 45–54 (5) | ○ 55–64 (6) | ○ 65–74 (7) | ○ 75–84 (8) |
| ○ 85 or older (9) | | | |

**Q4. What is the highest degree or level of education you have completed?**

| | | |
|---|---|---|
| ○ High school graduate (1) | ○ Completed some college (2) | ○ Associate degree (3) |
| ○ Bachelor's degree (4) | ○ Completed some postgraduate (5) | ○ Master's degree (6) |
| ○ Ph.D., law or medical degree (7) | | |

**Q9. What is your entry level physical therapy degree?**
❍ Certificate (1)   ❍ Bachelor's degree (2)   ❍ Entry- level Master's degree (3)   ❍ Entry-level Doctoral degree (4)

**Q6. Are you a physical therapist education program director?**
❍ Yes (1)   ❍ No (2)

**Answer If Are you a physical therapist education program director? Yes Is Selected And If you are not a program director, please indicate your role. Faculty member Is Selected**

**Q8. How many years have you participated in physical therapy education?**
❍ 0–1 years (1)   ❍ 1–5 years (2)   ❍ 6–10 years (3)   ❍ 11–15 years (4)
❍ 16–20 years (5)   ❍ 21–25 years (6)   ❍ 26–30 years (7)   ❍ > 30 years (8)

**Q7. How many years have you been interested in critical thinking and higher order thinking/constructs?**
❍ 0–1 years (1)   ❍ 1–5 years (2)   ❍ 6–10 years (3)   ❍ 11–15 years (4)
❍ 16–20 years (5)   ❍ 21–25 years (6)   ❍ 26–30 years (7)   ❍ > 30 years (8)

**Answer If Are you a physical therapist education program director? No Is Selected**

**Q10. If you are not a program director, please indicate your role.**
❍ Clinical practice (1)   ❍ Faculty member (2)
❍ Other (3) _____

**Q13. In the next sections, you will be presented with the critical thinking skills and the sub skills defined in Facione's (1990), The Delphi Report. Please read the definition of the critical thinking skill, and in your opinion which skill is the most important to have PRIOR to entrance to a physical therapy program. Please keep in mind, these are the skills that you feel a student should possess BEFORE beginning physical therapy school.**

**Q11. Interpretation is the ability to understand and convey the significance of an experience. The skills that make up interpretation are:**
• Categorization: occurs when experiences or beliefs are framed for better understanding decoding significance: the situation or experience is described in relation to affective attitudes or the motive behind situation
• Clarifying meaning: restating or paraphrasing the situation or experience in different terms to remove any ambiguity or confusion

**Q14. Categorization: occurs when experiences or beliefs are framed for better understanding**
❍ Not important (1)   ❍ Little importance (2)   ❍ Average importance (3)
❍ Very important (4)   ❍ Absolutely essential (5)

**Q15. Decoding significance: the situation or experience is described in relation to affective attitudes or the motive behind situation**
❍ Not important (1)   ❍ Little importance (2)   ❍ Average importance (3)
❍ Very important (4)   ❍ Absolutely essential (5)

**Q16. Clarifying meaning: restating or paraphrasing the situation or experience in different terms to remove any ambiguity or confusion**

◯ Not important (1)   ◯ Little importance (2)      ◯ Average importance (3)
◯ Very important (4)  ◯ Absolutely essential (5)

**Q17. Analysis is when concepts or situations are examined, and relationships are identified. The skills that make up analysis are: examining ideals: when ideas are compared and contrasted, and problems with the idea are identified and broken down detecting arguments: determining if an idea or situation has reasons to support or refute it analyzing arguments: a complex process where the conclusion, the reasons for the conclusion, support for those reasons and their structure, other outcomes, and outliers are identified and accepted or rejected**

**Q18. Examining ideals: when ideas are compared and contrasted, and problems with the idea are identified and broken down**

◯ Not important (1)   ◯ Little importance (2)      ◯ Average importance (3)
◯ Very important (4)  ◯ Absolutely essential (5)

**Q19. Detecting arguments: determining if an idea or situation has reasons to support or refute it**

◯ Not important (1)   ◯ Little importance (2)      ◯ Average importance (3)
◯ Very important (4)  ◯ Absolutely essential (5)

**Q20. Analyzing arguments: a complex process where the conclusion, the reasons for the conclusion, support for those reasons and their structure, other outcomes, and outliers are identified and accepted or rejected**

◯ Not important (1)   ◯ Little importance (2)      ◯ Average importance (3)
◯ Very important (4)  ◯ Absolutely essential (5)

**Q21. Evaluation is assessing the credibility of perceptions and logic of the relationships by assessing claims or arguments. The skills that make up evaluation are:**
• Assessing claims: recognizing factors that make the source of information credible
• Assessing arguments: judging if an argument is plausible or false

**Q24. Assessing claims: recognizing factors that make the source of information credible**

◯ Not important (1)   ◯ Little importance (2)      ◯ Average importance (3)
◯ Very important (4)  ◯ Absolutely essential (5)

**Q23. Assessing arguments: judging if an argument is plausible or false**

◯ Not important (1)   ◯ Little importance (2)      ◯ Average importance (3)
◯ Very important (4)  ◯ Absolutely essential (5)

**Q25. Inference uses querying evidence, finding alternatives and drawing conclusions to identify what is needed to make conclusions, or form hypotheses. Skills that make up inference are:**
• Querying evidence: occurs when additional support information is needed to develop or reinforce an argument and how to find that additional support information
• Conjecturing alternatives: creating other alternative ways to ask a question, multiple ways resolve an issue or project consequences
• Drawing conclusions: ensues when hypothesis are tested or opinions are compared to determine what to do or believe

**Q26. Querying evidence: occurs when additional support information is needed to develop or reinforce an argument and how to find that additional support information**

- ◯ Not important (1)
- ◯ Little importance (2)
- ◯ Average importance (3)
- ◯ Very important (4)
- ◯ Absolutely essential (5)

**Q27. Conjecturing alternatives: creating other alternative ways to ask a question, multiple ways resolve an issue or project consequences**

- ◯ Not important (1)
- ◯ Little importance (2)
- ◯ Average importance (3)
- ◯ Very important (4)
- ◯ Absolutely essential (5)

**Q28. Drawing conclusions: ensues when hypothesis are tested or opinions are compared to determine what to do or believe**

- ◯ Not important (1)
- ◯ Little importance (2)
- ◯ Average importance (3)
- ◯ Very important (4)
- ◯ Absolutely essential (5)

**Q44. An explanation is to declare or justify reasoning by stating the results, justifying the procedures and presenting arguments based on the context. The skills that make up explanation are:**

- Stating results: giving accurate statements
- Justifying procedures: presenting the evidence behind a decision
- Presenting arguments: giving reasons to accept a claim or decision

**Q29. Stating results: giving accurate statements**

- ◯ Not important (1)
- ◯ Little importance (2)
- ◯ Average importance (3)
- ◯ Very important (4)
- ◯ Absolutely essential (5)

**Q30. Justifying procedures: presenting the evidence behind a decision**

- ◯ Not important (1)
- ◯ Little importance (2)
- ◯ Average importance (3)
- ◯ Very important (4)
- ◯ Absolutely essential (5)

**Q32. Presenting arguments: giving reasons to accept a claim or decision**

- ◯ Not important (1)
- ◯ Little importance (2)
- ◯ Average importance (3)
- ◯ Very important (4)
- ◯ Absolutely essential (5)

**Q45. Self-regulation applies the "skills in analysis and evaluation" (p. 10) to monitor one's own cognitive activities through self-examination and self-correction. The skills that make up self-regulation are:**

- Self-examination: looking at the reasoning used, and opinions created, as well as "motivation, values, attitudes and interests" that determine the outcome
- Self-correction: occurs when self-examination shows an error in the decision or reason, and allows for correction of this mistake

**Q31. Self-examination: looking at the reasoning used, and opinions created, as well as "motivation, values, attitudes and interests" that determine the outcome**

- ◯ Not important (1)
- ◯ Little importance (2)
- ◯ Average importance (3)
- ◯ Very important (4)
- ◯ Absolutely essential (5)

**Q33. Self-correction: occurs when self-examination shows an error in the decision or reason, and allows for correction of this mistake**

- ◯ Not important (1)
- ◯ Little importance (2)
- ◯ Average importance (3)
- ◯ Very important (4)
- ◯ Absolutely essential (5)