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Confirming Deliberate Practice in Dietetics Education

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Abstract

Objective: To develop a valid and reliable instrument to define deliberate practice in dietetics education.

Design: Instrument development.

Setting: Dietetics education and supervision.

Participants: Twenty-three Registered Dietitians participated in the preliminary item tryout phase of the project and a total of 323 participants launched the instrument link for construct validation.

Main Outcome Measure(s): Fifty-five deliberate practice statements were tested for construct validation.

Analysis: Face and content validity of the instrument, along with initial reliability estimated were tested in the preliminary item tryout phase. Exploratory factor analysis was utilized to determine construct validity of the instrument.

Results: Initial reliability estimates were >.70 for most categories during the preliminary item tryout phase. Exploratory factor analysis resulted in a seven-factor solution with 32 items accounting for 59.72% of the shared variance.

Conclusion and Implications: Deliberate practice can be defined with the following characteristics: (1) opportunities to practice skills and hone knowledge; (2) experiential practice to demonstrate innate talent; (3) skills focused on a high level of patient centered nutrition care; (4) frequent and ongoing feedback; (5) reading and understanding evidence based practice literature; (6) professional education and networking opportunities; and (7) a non-judgmental learning environment where the student is free to make mistakes. (Abstract word count = 200).

Keywords: Deliberate Practice, Skill Development, Factor Analysis, Pilot Testing, Expertise, and Validation Check

1. Introduction

Deliberate practice (DP) serves as a potential conceptual framework to explore activities, attributes, and characteristics leading to expertise in a given field or domain, such as in the education of a Registered Dietitian (RD). First studied by Ericsson, Krampe, and Tesch-Römer (1993), DP encompasses attentive, concentrated, carefully planned activities fundamentally supporting the development of expertise in one's chosen field or domain. The concept of DP was studied across the domains of sports, gaming, music, and allied health professions for the purpose of understanding the key elements of the framework. Practice activities are considered DP under the following conditions: highly structured with purposeful goals; repetitive; feedback with active remediation; and lack of enjoyment with high concentration (Campitelli & Gobet, 2008; Charness, Tuffiash, Krampe, Reingold, & Vasyukova, 2005; de Bruin, Kok, Leppink, & Camp, 2014; de Bruin, Smits, Rikers, & Schmidt, 2008; Ericsson, 2013; Ericsson & Charness, 1994; Ericsson & Lehmann, 1996; Ericsson & Ward, 2007; Ericsson et al., 1993; Ford, Ward, Hodges, & Williams, 2009; Haag-Heitman, 2008; Johnson, Tenebaum, & Edmonds, 2006; Law, Côte, & Ericsson, 2007; McKinney & Davis 2003; Moulaert, Verwijnew, Rikers, & Scherpbier, 2004; Sonnentag & Kleine, 2000).

In attempts to define DP, researchers have investigated activities such as professional reading, individual and group practice, and individual and group study, which embody DP. Keith and Ericsson (2007) used interviews to highlight those activities, which could be defined as DP, as it related to the ability to typing. The interview questions surveyed participants' skill level, practice activities, and accumulated DP hours. The authors explored the relationship between the contribution of typing abilities, amount of previous experience in typing, DP activities (attending a typing class and individual practice time) and typing performance. In a similar attempt to define DP in nursing, Haag-Heitman (2008) developed an interview tool to identify essential personal and environmental attributes modulating the attainment of expert performance in practicing clinical nurses. Choosing a diverse and dynamic work, lifelong self-directed focus, and positive and engaged demeanor were the three important DP themes within the profession of nursing.

In addition to interviews, questionnaires have been developed to successfully explore the relationship between DP activities and expert achievement in the fields of teacher education, nursing, and medical school education (Dunn & Shriner, 1999; Haag-Heitman, 2008;

Moulaert et al., 2004). Similar DP themes between the two professions emerged when comparing the fields of teaching and nursing. Dunn & Shriner (1999) and Haag-Heitman (2008) highlighted the need for continued professional development, lifelong learning, and ensuring self-reflection to improve one's overall performance. The DP activities in medical school education focused on academic aspects of training future physicians and highlighted the importance of including questions on self-directed studying techniques, type and amount of reading professional literature, and type and number of books owned (Moulaert, Verwijnew, Rikers, & Scherpbier, 2004).

In previous research, semi-structured interviews were employed to identify a list of activities that encompass DP within an allied health education program, specifically within a dietetics education program. Over 100 activities, attributes, and characteristics of DP emerged. The identified elements were classified into categories, using a closed card sort method, reflective of the constructs defined in DP research. Preceptors were recruited from a convenience sample of Dietetic Internship Directors to complete the closed card sorting activity. A total of 45 preceptors fully completed the closed card sort utilizing an online electronic platform—OptimalSort©. The mean age of the participants was 42.9 years (SD $\pm$ 12.6). The mean years in the profession were 17.6 years (SD $\pm$ 12.2) and 11.2 years serving as a preceptor (SD $\pm$ 8.8). The average time to complete the card sorting activity was 41:09 minutes (SD $\pm$34:33). The participants were not financially or otherwise compensated. Based on the results of a closed card sort, those items with acceptable levels of agreement were included in the development of an instrument to define DP in supervised dietetics education (Haubrick, Molaison, Huye, Landry, & Mohn, 2018). Determining important activities, attributes, and characteristics leading to expert is of value to the body of knowledge of deliberate practice and fills a gap, which exists between deliberate practice and the professional domain arena. The purpose of this manuscript is to evaluate reliability and validity of an instrument defining DP in dietetics supervised practice based on the opinions of practitioners and educators in dietetics and allied-health professions.

2. Methods

Card sorting, which categorizes like information, was utilized in previous research to group like activities, attributes, and characteristics into the core constructs reflective of DP. After the completion of the card sorting activity, cards with acceptable levels of percent agreement (e.g., 43% and higher) and theoretical support were used to develop items for a draft instrument (Huye, 2011; Spencer, 2009). The items used represented DP activities, attributes, and characteristics (Haubrick et al., 2018). A total of 55 items, plus four randomly inserted validation (bogus) check items, were included in the draft instrument for use in the preliminary item tryout phase (Huang, Curran, Keeny, Poposki, & DeShon, 2012; Meade & Craig, 2012). The instrument included basic demographic data (i.e., sex, years in dietetics practice, age, highest degree obtained, role in the dietetics profession, and state of residence).

A 7-point Likert-type scale was used to determine the level of agreement with the listed activities in order to define DP in dietetics education (Dunn & Shriner, 1999; Likert, 1932; Moulaert et al., 2004). The draft instrument underwent face and content validity testing to assure understanding of the instrument by the participants and to eliminate irrelevant items

(Lynn, 1986; Thomas, Hathaway, & Arheart, 1992). Other items reviewed during the face validity testing included grammar, typical completion time, usefulness of the scale in assessing agreement, and clarity of statements (Burns & Grove, 2009; Johnson & Christensen, 2012; Walonick, 2010). Participants were allowed to provide suggestions to include any items they felt were missing. To encourage participation, a drawing for one $50 gift card was offered to those who completed the review.

The draft instrument was revised based on the feedback provided during the face validity testing. The instrument was initially evaluated to ensure reliability using Cronbach's α. An internal consistency goal of 0.70 or higher was desired to help identify items that did not fit within the proposed categories of DP activities (Burns & Grove, 2009).

After revisions, 1,100 members of the Academy of Nutrition and Dietetics' (Academy) Practice Group—Nutrition and Dietetics Educators and Preceptors (NDEP)—were invited, via an email listserv request, to participate. A hyperlink to the instrument was included within the email request. In addition to the initial email request, a two-week reminder email was also sent to NDEP members via the listserv. The membership of NDEP is open to any Academy member, who pays the dues for an additional practice group. Membership of NDEP includes dietetics educators and preceptors who work with students during practicum with a general understanding of the learning activities partaken during supervised practice, and general practitioners who wish to join the NDEP practice group. Additionally, NDEP members were encouraged to send the questionnaire out to other educators and preceptors who may not be a member of NDEP to increase the number of potential participants. To encourage participation, a drawing for one $100 gift card and a drawing for two $50 gift cards were offered to those who completed the review. To assure at least fair estimated factor reliability, a sample size of 200-300 was the goal for this portion of the research (Field, 2009; Mertler & Vannatta, 2013).

An exploratory factor analysis (EFA) was used to determine construct validity of the revised instrument (Burns & Grove, 2009; Johnson & Christensen, 2012). Principal axis factoring was chosen over principal component analysis because of the primary goal of identification of constructs (Field, 2009). During this step, scree plots for the number of potential factors, amount of variance explained by each factor, and the loading for each item on the factor were evaluated. The minimal acceptable cut off point for factor loading in an unknown model is 0.30 (Burns & Grove, 2009; Mertler & Vannatta, 2013). Stevens (2002) recommended for a sample size of 200 a loading of at least 0.364 to be considered significant and a sample size of 300 a loading of at least 0.298 to be considered significant. Therefore, a conservative cut off point for factor loading was established at 0.35.

The goal of the factoring was to achieve simple structure with items loading only on one construct; therefore, simple structure was chosen over parallel analysis and Velicer's minimum average partial (MAP) to avoid over- or under-loading of items into a construct (O'Connor, 2000). Since it was anticipated the constructs would correlate based on their theoretical overlap, an oblique factor (direct oblimin) rotation was utilized. (Burns & Grove, 2009; Field, 2009; Mertler & Vannatta, 2013). Cross correlations between the extracted factors as well as Cronbach alphas were calculated after the factor solution. SPSS® (version 23) was used to analyze the data.

3. Institutional Review Board

This project was reviewed and approved by the Institutional Review Board (IRB) at the University of Southern Mississippi with an expedited review and implied consent was obtained from all participants.

4. Results

A total of 23 individuals participated in the preliminary item tryout. Of the participants, 22 were female and all held the Registered Dietitian (RD) credential. The majority of the respondents (*n*=16) were practitioners, with two respondents employed as program directors of an accredited dietetics education program (one from a dietetic internship and one from a didactic program in dietetics) and four faculty members. The mean age of the respondents was 39.6 years (SD ± 14.3) with 14.1 years of experience (SD ± 13.2).

Of those respondents who completed the evaluation of the instrument for face and content validity, 100% (*n*=21) reported the instructions for the instrument were clear, items were written clearly, the overall layout and flow was clear and easy to understand, and the length of the instrument was appropriate. The majority of respondents preferred to use the term "intern" (*n*=13) compared to "student" (*n*=8); therefore, the term "intern" was used in the final instrument. Respondents were asked if there were any items they would exclude from the instrument and 3 out of 21 respondents stated "yes" to this question. However, only one respondent provided an actionable comment indicating some statements only elicited positive responses. After reviewing the frequency report for responses, six scale items were identified with 100% responses of either agreed or strongly agreed responses. These items were rewritten to make the statements elicit responses across the scale spectrum compared to eliciting only highly positive responses. For example, "A learning environment is safe, challenging, and positive" was rewritten to "A learning environment that supports the intern."

Cronbach alphas were calculated to determine construct consistency for items of the proposed instrument (Table 1). All values were above the threshold of .70 except for "Methods of coaching or precepting," which was .302. When considering the strong theoretical backing for this construct, researchers elected to retain in the scale. Thus, the 55 initial items were included in the final instrument.

Table 1. Reliability of constructs from preliminary item tryout

Construct	Number of items in construct	Cronbach alpha
Student possesses natural abilities to be successful in the profession	14	.866
Methods of coaching or precepting	4	.302
Supervised practice activities that need more time	6	.807
Methods to increase performance	7	.845
Characteristics of student-preceptor relationship	13	.779
Activities that promote lifelong learning	4	.873
Foundational education activities to be a successful practitioner	6	.746
Total	55[a]	.926

Although the current membership by the NDEP was reported to be 1,100 members, a total

1,316 NDEP members received the initial email request. Of 1,316 potential participants, 430 individuals opened the initial email request (32.7%). Two weeks later, a reminder email was sent out to all members of NDEP. At this point, 1,318 members received the reminder email request and 489 members opened the email (37.1%). The initial email request and two-week reminder email were sent to the same pool of participants; therefore, no method was available to know how many members of NDEP opened both messages. Additionally, researchers requested NDEP members pass the email along to other professionals in their network who may be interested in responding. Utilizing this snowball sampling technique may have added to the total number of potential participants, which cannot be quantified.

A total of 323 individuals launched the instrument link. Of those, 255 (79.0%) respondents completed the instrument with an additional 68 (21.0%) partially completed responses, which were excluded from final analyses. Data from participants who did not complete or accurately complete 75% (three out of four) of the validation check questions were also eliminated from the data set (n=11/4.3%). A total of 244 useable responses were available for data analysis. Prior to data analysis, missing data points were replaced with the linear trend point of each item of the scale (Field, 2009).

The participants who completed the instrument held the RD credential (99.2%), were predominately female (97.5%), were between the ages of 51-60 (27.0%), and had 31-40 years of experience (26.2%). More than half of the participants had earned a masters (60.2%) and nearly a third held a doctorate (27.9%) degree. See Table 2 for a complete demographic profile of the participants.

Initial visual evaluation of the scree plot indicated extraction of five to nine factors. The most widely utilized tool for factor extraction is The Kaiser's Criterion, which recommends extraction of all factors with eigenvalues greater than one. Unfortunately, Kaiser's Criterion tends to over-estimate the number of factors to extract; therefore, parallel analysis and Velicer's minimum average partial (MAP) were calculated (Field, 2009). Parallel analysis, which tends to over identify, indicated to retain an eight-factor solution. Velicer's MAP, which tends to under identify, indicated to retain a six-factor solution (Field, 2009; O'Connor, 2000). Because of the potential over and under estimations of parallel analysis and Velicer's MAP, the need for factors to make theoretical sense, and the goal of simple structure, extraction of seven factors were retained in the final analysis with a factor loading cut off of 0.35.

The Kaiser Meyer Olkin (KMO) measure verified the sampling adequacy of the analysis. The KMO measure was equal to .827, which is considered "good" (Field, 2009). Barlett's test of sphericity chi-square (496) = 3084.178, $p < .001$, which indicated correlations between items were sufficiently large for principal axis factoring. Table 3 details the factors of the seven-factor simple structure model, which explained 59.72% of the variance.

Table 2. Demographic profile of participants (N = 244)

Characteristics	*n*	Percent
Gender[a]		
Male	6	2.5
Female	236	97.5
Credentials[b]		
RD or RDN	242	99.2
DTR or NDTR	2	0.8
Other	19	7.8
Years in practice		
0-10	62	25.4
11-20	57	23.4
21-30	55	22.5
31-40	64	26.2
>40	6	2.5
Age[a]		
21-30	18	7.7
31-40	61	26.1
41-50	51	21.8
51-60	63	27.0
61-70	38	16.2
>70	3	1.3
Role in dietetics[a]		
Program Director[a]	100	41.2
DPD (Didactic Program in Dietetics)	26	26.0
DI (Dietetic Internship Program)	61	61.0
CP (Coordinated Program)	10	10.0
DT (Dietetic Technician Program)	2	2.0
Faculty member	68	30.0
DPD	31	45.6
DI	16	23.5
CP	14	20.6
DT	6	8.8
Other	1	0.2
Practitioner	49	20.1
Practitioners (current preceptors)	43	87.8
Practitioners (not current preceptors)	6	12.2
Other	26	10.7
Highest degree obtained		
2 year degree	0	0.0
4 year degree	29	11.9
Masters	147	60.2
Doctorate	68	27.9
NDEP Region		
1	45	18.4
2	30	12.3
3	27	11.1
4	50	20.5
5	33	13.5
6	28	11.5
7	31	12.7

[a]Category is missing data point(s)

[b]Participants could select more than one option

Table 3. Factor loadings for a seven-factor structure including eigenvalues and percentage shared variance

Factors	Loading	λ	% Shared variance
Factor one: Methods to increase performance		6.99	21.83
Q33. A dedicated study schedule	.754		
Q27. Intern reviews notes from coursework	.665		
Q25. A quiet and conducive environment for studying	.612		
Q13. Studying with flash cards	.589		
Q47. Outlines to assist the intern when studying	.573		
Q18. Intern-developed case scenarios used as a study guide	.437		
Q03. Individual and group practice exams	.430		
Factor two: Natural abilities		3.11	9.71
Q09. Emotional intelligence to cultivate positive relationships	-.850		
Q14. Positive relationships where the intern is able to connect with others	-.609		
Q12. Personal interactions allowing the intern to demonstrate mature character	-.510		
Q19. Culturally competent communication techniques are used by the intern	-.509		
Q07. Resiliency in a difficult situation	-.397		
Factor three: Activities requiring focused time		2.67	8.34
Q17. More time spent on critical care activities as compared to all other activities	.916		
Q23. More time spent on advanced clinical nutrition activities as compared to all other activities	.856		
Q02. More time spent on nutrition support activities as compared to all other experiences	.704		
Q45. More time spent on nutrition assessment skills as compared to all other experiences	.570		
Factor four: The coaching process		2.07	6.47
Q49. Designated time for the preceptor to provide feedback	.625		
Q46. Preceptors provide feedback in a one on one setting	.574		
Q42. Formal, end of rotation evaluations	.512		
Q43. A common set of goals established between the intern and the preceptor	.502		
Q50. Additional feedback is provided when a intern who does not possess natural and academic abilities	.488		
Q59. Preceptors provide ongoing and daily feedback	.437		
Factor five: Educational activities within the curriculum		1.84	5.75
Q41. Develop an understanding of research and statistical methodology by reading journal articles	.809		
Q40. Exposure to specialty information by reading journal articles	.704		
Q58. Required readings to stay abreast of current topics	.555		
Q56. A literature review used as part of evidence based practice	.527		
Factor six: Lifelong learning		1.30	4.05
Q39. Professional meetings and conferences to further develop knowledge within one's practice area	.734		
Q24. Professional network opportunities to further develop knowledge	.679		
Q53. Professional organization membership to further develop knowledge within one's practice	.678		
Factor seven: The learning environment		1.14	3.57
Q31. Opportunities to practice and develop skills are ample	-.741		
Q32. A learning environment that supports the intern	-.722		
Q22. Preceptors who provide constructive feedback and suggestions for improvement	-.492		

Note: λ = eigenvalues

Table 4 highlights the means and standard deviations for the seven subscales, correlations between the factors, and internal consistency estimates. All factors within the solution noted significant low to moderate correlations (ranging from .169 to .475) except for the relationships between activities requiring focused time and natural abilities (r=.089), lifelong learning (r=.097), and the learning environment (r=.113). All factors within the solution

demonstrated an acceptable level of internal consistency. Mean differences between factor subscales did not exist between the different groups—educators, practitioners, and preceptors—who participated in the research study.

Table 4. Factor correlations and reliability estimates

Factor	M[a]	SD	1	2	3	4	5	6	7
1. Methods to increase performance (n = 7)	4.49	.90	(.82)						
2. Natural abilities (n = 5)	6.13	.62	.279[b]	(.80)					
3. Activities requiring focused time (n = 4)	4.35	1.12	.301[b]	.089	(.85)				
4. The coaching process (n = 6)	6.14	.57	.407[b]	.259[b]	.141[c]	(.73)			
5. Educational activities within the curriculum (n = 4)	5.64	.79	.364[b]	.235[b]	.171[c]	.368[b]	(.80)		
6. Lifelong learning (n = 3)	5.46	.89	.384[b]	.409[b]	.097	.240[b]	.383[b]	(.73)	
7. The learning environment (n = 3)	6.52	.59	.169[b]	.475[b]	.113	.328[b]	.143[b]	.172[b]	(.73)
Total instrument (n = 32)	5.46	.49							(.88)

[a]Range from 1.00 to 7.00

[b]Correlation is significant at the 0.01 (2-tailed)

[c]Correlation is significant at the 0.05 (2-tailed)

Note: Cronbach's alpha levels appear in the parentheses on the diagonal

5. Discussion

The factor analysis yielded a seven-factor solution, which provided an initial definition of deliberate practice within supervised dietetics education in order to apply a working definition of deliberate practice to supervised dietetics education. Many of the factors identified—such as methods to increase performance, need for feedback and remediation, and natural abilities—within the factor solution correspond directly to previous results within the literature.

'Methods to increase performance' was the strongest factor, one of two factors with the most factor loadings, and explained the greatest amount of shared variance. All of the items within this particular factor related to studying, study techniques, and the studying environment. Study techniques are an important aspect to improve performance within DP (Charness et al., 2005; de Bruin et al., 2008; Keith & Ericsson, 2007; Moulaert et al., 2004). Moulaert and colleagues (2004) noted in their research, participants spent an average of 31.9 hours per week on study-related activities with lower achieving students spending less time on self-directed study activities (2.3 hours, $p < 0.05$). Studying, self-study, study techniques are important when defining DP in supervised dietetics education as indicated by a Cronbach's alpha of .82 and as in the previous DP literature (Charness et al., 2005; de Bruin et al., 2008; Keith & Ericsson, 2007; Moulaert et al., 2004).

One must have innate talent—genetic factors of exceptional performance which are not necessarily obtained by education or training, plus the dedication of practice that is deliberate in nature, in order to achieve expert performance (Ericsson et al. 1993; Galton, 1979; Gang é

1999). Emotional intelligence, positive relationships, mature personal interactions, culturally competent communication, and resiliency were important natural abilities attributes and characteristics in supervised dietetics education. The item *Personal interactions allowing the intern to demonstrate a mature character* was originally written for a differing construct during the preliminary item tryout; however, the item theoretically made sense within the 'Natural abilities' construct after the EFA, since having a mature character could be considered a natural attribute of an intern (Gangé, 1999). The inclusion of natural abilities in the equation of obtaining expert performance is highlighted within previous literature; similarly, the results of this research support the inclusion of natural abilities (α=.80) as a part of the definition of DP in supervised dietetics education (Ericsson et al. 1993; Galton, 1979; Hodges, Kerr, Starkes, Weir & Nananidou, 2004).

The concept of time is important because the framework of DP indicates achieving expert performance will occur only after a sufficient amount of practice time (de Bruin et al. 2008; Law et al., 2007; Ward, Hodges, Starkes & Williams, 2007). The items within the factor of 'Activities requiring focused time' provide support for the need to focus more time on critical care, clinical nutrition, nutrition support, and nutritional assessment activities when defining DP in supervised dietetics education (α=.85). Activities needing more focused time herein include critical care, clinical nutrition, nutrition support, and nutritional assessment, which converge to craft the more medically complex clinical nutrition activities of a RD. The support for medically complex clinical nutrition activities is in alignment with the 2017 RD national credentialing examination blueprint. The RD exam focuses 40% of the overall test questions on nutritional care for individuals and groups (Commission on Dietetic Registration, 2016).

Providing active remediation and feedback are important characteristics when defining DP (de Bruin et al., 2008; Dunn & Shriner, 1999; Ericsson, 2013; Ericsson & Charness, 1994; Ericsson & Lehmann, 1996; Ericsson & Ward, 2007; Ericsson et al., 1993; Ford et al., 2009; Johnson et al., 2006; Law et al., 2007; Moulaert et al., 2004;). The outcome of the EFA collapsed the items 'Methods of coaching and precepting' and 'Characteristics of the intern-preceptor relationship' into one factor named 'The coaching process.' The factor had the second most number of factor items loaded (n=6) as well as 6.5% shared variance of the overall solution. Therefore, 'The coaching process,' providing active remediation and feedback, is important when defining DP in supervised dietetics education and within the DP literature albeit a lower alpha coefficient in this construct.

Important to any curriculum are the educational activities, which guide the learning process. Thus, determining practice activities within the educational curriculum to improve performance are a necessary function, and the need is evident through the literature.[2,39] Interestingly, the items within the factor 'Educational activities with the curriculum' focused completely on reading information to support foundation knowledge and reading research literature. These particular educational activities are essential when defining DP within supervised dietetics education (α=.80) as they provide the foundation to the learning process. The idea that professional reading is a key activity in DP was supported in areas such as chess, teaching, medical school education, and rhythmic gymnastics (Campitelli & Gobet, 2008;

Charness et al., 2005; Moulaert et al., 2004; Dunn & Shriner, 1999; Ward et al., 2007).

Dunn and Shriner (1999) and Haag-Heitman (2008) noted the importance of the lifelong learning process, in particular attendance at seminars and workshops within their literature. *Attendance at professional meetings, networking opportunities, and membership within a professional organization* were the items that loaded to the factor of 'Lifelong learning.' The convergence of the items within this factor provided theoretical support (α=.77) for the need of an individual's continued learning and self-reflection throughout his or her dietetics' career and is supported within the literature.

Lastly, the factor identified as 'The learning environment' was not found in previous literature and is a newly proposed construct reflective of DP. Unfortunately, this factor only had three items loaded, loaded last in the EFA, and the smallest percentage shared variance as well as an alpha coefficient close to the threshold of ≥ .70. Therefore, future testing could include the addition of new items to strengthen this factor.

In summary, the instrument described within this manuscript is a novel instrument measuring the activities, attributes, and characteristics of DP in supervised dietetics education based on the opinions of practitioners and educators in dietetics and allied-health professions. The activities, attributes, and characteristics of DP in supervised dietetics education offered many similar, but minor differences in the results compared to the literature. The newly developed instrument included fundamental characteristics of DP such as methods to increase performance, the need for natural abilities, and the importance of feedback and remediation similar to the findings of others defining DP within their chosen field or domain. Also results indicated the inclusion of educational activities within the curriculum and lifelong learning within the instrument, which were a part of the DP literature reflective of the professional domain (Dunn & Shriner, 1999; Haag-Heitman, 2008). Noted differences of the results indicate the inclusion of elements of the learning environment as well activities requiring focused time. This is the first instrument, to the knowledge of this researcher, measuring DP in supervised dietetics education.

5.1 Limitations

There were several limitations to the research. First, the sample size for the EFA (n = 244 participants) was considered "fair" to "good" for estimated factor reliability (Walonick, 2010). To provide improved results for an EFA, a sample size of ≥ 300 would be ideal to strengthen the results. Since not all educators and preceptors are NDEP members, it would be beneficial to determine alternative methods to reach a larger pool of educators and preceptors to increase the sample size to larger than 300 participants. Potentially, administering the questionnaire to all members of the Academy of Nutrition and Dietetics, then filter by categories of educator and preceptor could be an alternative approach to reach educators and preceptors who are a member of the Academy but not a member of NDEP. Lastly, DP has never being defined in supervised dietetic practice and thus there are limited data, within the literature, on defining activities that are required in the development of an allied health professional. The lack of data creates a gap within the literature on the topic of DP in supervised dietetics education.

6. Implications for Research and Practice

Future research may first include the development of new items, especially for the constructs, 'lifelong learning' and 'the learning environment', to strengthen the overall reliability of the instrument. The least number of items loaded on these constructs and these were loaded last in the EFA. In addition, 'lifelong learning' was a new construct not yet mentioned in deliberate practice literature. The lower reliability estimates, while although acceptable in introductory research on instrument development, may need to be improved as psychometric evaluations are conducted on the instrument.

Future utility for this instrument includes the use of predictive statistics to model outcomes in dietetics education. Each mean construct response plus the overall score of the instrument, could be employed to predict such outcomes as employment rates, completion or graduation rates of interns, placement into graduate school, and/or RD examination scores. Historically, dietetic internship directors use academic markers (i.e. grade point average or Graduate Record Exam scores) to predict success on passage of the RD credentialing examination and thus initiate potential admittance into the dietetics program. Current research predicting RD credentialing examination success is helpful to inform dietetic internship directors when to admit the most qualified student, yet, these studies do not aim to address what types of educational activities make one successful or competent to practice in dietetics. Thus, by defining DP in supervised dietetics education, important qualitative activities, attributes, and characteristics, which are missing from the research focusing on specific academic markers for success, are able to be quantified. Merging the qualitative elements of expert performance of this research with the quantitative academic measures could provide further benefit to those involved in the education and training of a Registered Dietitian.

7. Conclusion

The purpose of this manuscript was to establish reliability and validity of an instrument measuring DP in dietetics supervised practice, based on the opinions of practitioners and educators in dietetics and allied-health education, so characteristics of DP in dietetics education can be defined. Although DP in dietetics has not been defined in the literature, the findings of this research indicated a seven-factor solution with adequate factor loadings above +/- .35 and sufficient alpha coefficients. From the outcome of this research, DP within supervised dietetics education can be defined by the following characteristics: (1) regular and systematic opportunities to practice skills and hone knowledge; (2) opportunities embedded within experiential practice to demonstrate innate talent; (3) dedicated time to cultivate skills focused on a high level of patient centered nutrition care; (4) frequent and ongoing feedback; (5) activities devoted to reading and understanding evidence based practice literature; (6) professional education and networking opportunities; and (7) a non-judgmental learning environment where the student is free to make mistakes. The definition of DP in supervised dietetics education encompasses many of the important facets outlined from the literature. Due to the limitations outlined in this study, further instrument testing may be needed to confirm the proposed definition of DP in supervised dietetics education.

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