Unveiling student perceptions: the role of computerised business simulations in fostering psychological empowerment among business students

Percepciones de los estudiantes: el papel de las simulaciones de negocios computarizadas en el fomento del empoderamiento psicológico entre los estudiantes de negocios

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ABSTRACT. Psychological Empowerment (PE) is a multidimensional construct critical for understanding how individuals perceive themselves, interact with their environments, and take actions to influence outcomes. While traditionally conceptualised as encompassing intrapersonal, interactional, and behavioural dimensions, this study employs exploratory factor analysis (EFA) to evaluate and refine the theoretical framework for PE. The research aimed to address limitations in existing models, which often overlook the multidimensionality of empowerment, by developing a scale aligned with its three theoretical dimensions. Conducted in the context of the RETO 2024 global business simulation competition, this study surveyed 451 participants from diverse academic and cultural backgrounds, analysing their experiences and perceptions of empowerment.

The findings reveal that the empirical data support a two-factor model of PE rather than the originally hypothesized three-factor structure. The intrapersonal and behavioural dimensions converge into a unified factor—Cognitive-Behavioural Empowerment—capturing the interplay between self-perceptions and actions such as decision-making, leadership, and teamwork. The interactional dimension remains distinct, reflecting analytical and contextual skills essential for navigating complex environments. This refinement enhances the theoretical clarity and practical applicability of PE, providing a robust framework for evaluating and fostering empowerment in educational and professional contexts.

RESUMEN. El empoderamiento psicológico (PE) es un constructo multidimensional fundamental para comprender cómo los individuos se perciben a sí mismos, interactúan con su entorno y toman medidas para influir en los resultados. Si bien tradicionalmente se conceptualiza como que abarca dimensiones intrapersonales, interaccionales y conductuales, este estudio emplea análisis factorial exploratorio (AFE) para evaluar y refinar el marco teórico de la EP. La investigación tuvo como objetivo abordar las limitaciones de los modelos existentes, que a menudo pasan por alto la multidimensionalidad del empoderamiento, mediante el desarrollo de una escala alineada con sus tres dimensiones teóricas. Realizado en el contexto de la competencia global de simulación empresarial RETO 2024, este estudio encuestó a 451 participantes de diversos orígenes académicos y culturales, analizando sus experiencias y percepciones de empoderamiento.

Los hallazgos revelan que los datos empíricos respaldan un modelo de PE de dos factores en lugar de la estructura de tres factores originalmente hipotetizada. Las dimensiones intrapersonal y conductual convergen en un factor unificado, el empoderamiento cognitivo-conductual, que captura la interacción entre las autopercepciones y acciones como la toma de decisiones, el liderazgo y el trabajo en equipo. La dimensión interaccional sigue siendo distinta y refleja habilidades analíticas y contextuales esenciales para navegar en entornos complejos. Este refinamiento mejora la claridad teórica y la aplicabilidad práctica de la educación física, proporcionando un marco sólido para evaluar y fomentar el empoderamiento en contextos educativos y profesionales.

1. Introduction

Empowerment, as a multifaceted construct, is essential for understanding power dynamics and control within society (Robbins et al., 2002). Within educational contexts, empowerment captures an individual's self-perception, strengths, decision-making authority, and confidence in achieving goals (Zimmerman and Rappaport, 1988; Spreitzer, 1995). The concept of learners' empowerment (Frymier et al., 1996) highlights its relevance across diverse academic disciplines, including sciences (Hassi and Laursen, 2015), nursing (Kennedy et al., 2015), and counselling (McWhirter, 1998).

Empowered students are better equipped to overcome challenges, make decisions, and develop resilience, alongside cognitive and social competencies such as trust, collaboration, and communication (Sibthorp and Arthur-Banning, 2004; Huff and Johnson, 1998). These attributes are vital for holistic student development and essential for thriving in complex, interdisciplinary learning environments. Despite this, previous research has primarily focused on intrapersonal aspects of PE, such as motivation and perceived control (Brooks and Young, 2011), while interactional and behavioural dimensions - critical for collaboration and practical application - remain underexplored (Hassi and Laursen, 2015). Existing instruments often target narrow elements of empowerment, such as leadership or engagement, without offering a comprehensive framework that addresses the multidimensional nature of PE (Sibthorp and Arthur-Banning, 2004; Hart et al., 2007).

This research seeks to address this critical gap by developing a scale that captures PE holistically, encompassing its intrapersonal, interactional, and behavioural dimensions. By doing so, it provides a tool to evaluate and foster empowered students who are resilient, adaptable, and capable of excelling in dynamic educational and professional contexts.

Furthermore, this study enhances the evaluation of student learning by moving beyond traditional metrics like grades, offering new insights into how courses align with student and employer expectations. The lens of PE allows for a deeper understanding of self-regulated learning (Zimmerman and Schunk, 2011; Panadero, 2017) and introduces innovative approaches to self-assessment and peer assessment (Biggs and Tang, 2007). Empowering students not only aids in their academic and professional growth but also addresses broader challenges such as mental health by promoting resilience and a sense of control (Spreitzer, 2007), while enhancing career readiness and employability (Crant, 2000; Fugate et al., 2004). As such, PE is integral to institutional efforts to drive quality and transformation in higher education (Harvey and Green, 1993; Cheng, 2016).

The development of this scale involved rigorous exploratory factor analysis adopting a survey instrument applied in a dynamic educational setting: an international business and management competition (Arroteia et al., 2021). This immersive environment required students to manage a simulated multinational business expansion, fostering critical decision-making, collaboration, and risk management skills.

2. Literature review

PE is a multifaceted construct that reflects an individual's intrinsic task motivation, rooted in four key cognitions: impact, competence, meaningfulness, and choice (Thomas and Velthouse, 1990; Riger, 1993). These cognitions collectively enhance self-awareness of factors that hinder or support goal achievement and the enactment processes through which individuals exert influence in their environment via social interactions (Zimmerman and Warschausky, 1998; Speer and Hughey, 1995).

This study adopts Zimmerman's (1995) construct of PE, which has served as the foundation for numerous subsequent studies. Zimmerman's framework defines PE as the capacity to identify opportunities, influence decisions, and exert effort to achieve desired goals. The construct is subdivided into three interconnected sub-constructs: intrapersonal, interactional, and behavioral, each of which is critical to understanding the full scope of empowerment.

2.1. Intrapersonal Component

The intrapersonal dimension of PE reflects how individuals perceive themselves and their capacity for self-determination. It encompasses motivation, perceived competence, and perceived control over decisions that impact one's life (Zimmerman, 1995; Spreitzer, 1995). This dimension embeds a sense of personal agency, characterised by active self-reflection, self-regulation, and self-efficacy (Deci and Ryan, 1985, 2002). For example, individuals who feel capable of controlling their circumstances are more likely to take ownership of their learning and decision-making processes, which is critical in educational and professional contexts.

2.2. Interactional Component

The interactional dimension highlights how individuals utilize their cognitive and analytical skills to navigate and manage their environment effectively. This includes developing critical awareness, problem-solving abilities, and understanding causal dependencies (Thomas and Velthouse, 1990; Spreitzer, 1995; Hassi and Laursen, 2015). By analyzing available resources and understanding the options within their context, individuals gain the ability to influence their environment (Zimmerman, 1995, 2000).

2.3. Behavioural Component

The behavioural dimension represents the actions individuals take to influence outcomes and exert power within their social contexts. This component focuses on behaviours such as social participation, interaction, and the ability to exert power or influence over others (Zimmerman, 1995). Through these behaviours, individuals translate their sense of control and decision-making capacity into tangible actions that shape their environment and drive desired outcomes.

Table 1 presents a summary of the most influential research studies on PE in educational contexts, highlighting the measurement instruments and the dimensions of PE they address. This synthesis informed the methodological approach and scale development for the current research.

Author(s)	Methodology	Sample	Theoretical contributions
Frymier et al., 1996	Quantitative	Study 1 n=470 Study 2 n=340	Developed the Learner Empowerment Scale.
Huff and Johnson, 1998	Quantitative	46	Revealed that empowering techniques increased students' perception of empowerment in the classroom.
Sibthorp and Arthur-Banning, 2004	Quantitative	190	Explored how personal empowerment plays an instrumental role in the development of outcomes such as task leadership.
Weber et al., 2005	Quantitative	209	Validated an 18-item version of the Learner Empowerment Scale (Frymier et al., 1996) as a measure of student interest.
McQuillan, 2005	Qualitative	116 students and 21 teachers	Explored the academic, political, and social dimensions of student empowerment. Addresses the importance of empowering teachers as a means to empower students.
Sheard and Golby, 2006	Quantitative	52	Analysed the effect of outdoor adventure education developing the psychological characteristics of participants: mental toughness, hardiness, dispositional optimism, self-esteem, self-efficacy, positive and negative affectivity.
Hart et al., 2007	Quantitative	777	Acknowledged empowerment as a form of motivation resulting from both internal learner characteristics and situational factors such as teacher behaviours. Empowerment was significantly associated with motivation, immediacy, relevance, learning and self-esteem.

Author(s)	Methodology	Sample	Theoretical contributions
Sibthorp et al., 2007	Quantitative	663	Empowering program participants to take responsibility and make decisions led participants to feel they learned more.
Schrodt et al., 2008	Quantitative	1,416	This study extends previous research by examining the extent to which instructors' prosocial and antisocial power use in the college classroom impacts learner empowerment. I
Houser and Frymier, 2009	Quantitative	185	Expanded Frymier et al.'s (1996) model of empowerment to include both individual (student) characteristics and situational (teacher) characteristics. Empowered learners are more motivated to perform classroom tasks and feel more competent in the classroom, find the required tasks more meaningful, and feel they have an impact on their learning processes.
Brooks and Young, 2011	Quantitative	490	Analysed the relationship between motivation and learners' empowerment.
Hassi and Laursen, 2015	Qualitative	19 individual interviews and 49 students in focus-group	Identified three interrelated aspects of PE outcomes for mathematics students: Self-empowerment (positive self-perceptions, agency and self-regulation, enjoyment of learning mathematics), Cognitive empowerment (enhanced thinking- and problem-solving skills); Social Empowerment (social competence, and skilled communication).
You, 2016	Quantitative	490	The results showed that Psychological Capital had a significant positive relationship with learning empowerment and that it indirectly enhanced engagement.

Table 1. Literature summary of student's psychological empowerment. Source: Self-made.

3. Methodology

This study was conducted in four systematic stages to develop and validate a scale for measuring PE as an outcome of students' experiences in a simulated business environment.

3.1. Stage 1: Survey Design

The survey instrument was designed following a post-positivist approach (Eisenhardt, 1989), informed by a comprehensive review of the literature. Variables relevant to measuring PE were identified and aligned with its three dimensions: Intrapersonal, Interactional, and Behavioral. This alignment ensured that the survey captured a holistic view of PE outcomes. The instrument incorporated variables that reflect self-perceptions, cognitive engagement, and actionable behaviours in social contexts.

The survey instrument established for this research was derived from the literature review (Table 2). The survey comprises 18 items, each designed to measure one variable within one of the three dimensions of PE. Each statement in the survey used a five-point Likert-type scale: 1 – Not at all, 2 – Not very much, 3 – Somewhat/Somehow, 4 – Very much, 5 – Extremely, to capture respondents' perceptions (Norman, 2010; Brown, 2011) (survey in Appendix 1).

Nr.	Variable name	Originated from the following studies	PE component
1	Resilience	You, 2016; Hassi and Laursen, 2015; Houser and Frymier, 2009; Hart et al., 2007; Lord and Hutchinson, 1993; Yasin and Hafeez, 2018	Intrapersonal
2	Reflective Ability	You, 2016; Hassi and Laursen, 2015; Houser and Frymier, 2009; Deci and Ryan, 2002; Lord and Hutchinson, 1993	Intrapersonal
3	Ability to Work Independently	You, 2016; Hassi and Laursen, 2015; Houser and Frymier, 2009; Lord and Hutchinson, 1993	Intrapersonal
4	Competitive Abilities	Hassi and Laursen, 2015; Houser and Frymier, 2009	Intrapersonal

Nr.	Variable name	Originated from the following studies	PE component
5	Creativity	You, 2016; Hassi and Laursen, 2015; Houser and Frymier, 2009; Lord and Hutchinson, 1993	Intrapersonal
6	Motivation for learning	You, 2016; Hassi and Laursen, 2015; Houser and Frymier, 2009; Hart et al., 2007; Sibthorp et al., 2007; Brunson and Vogt, 1996; Lord and Hutchinson, 1993	Intrapersonal
7	Decision-Making	Entails a sense of competence (self-efficacy) by which an individual belief in own's capacity to perform a task to achieve the desired outcome (Hassi and Laursen, 2015; Sibthorp and Arthur-Banning, 2004, Zimmerman, 1995, 2000; Frymier et al., 1996; Sherer et al., 1982; Bandura, 1977), and self-determination (Schwarzer and Jerusalem, 1995; Spreitzer, 1995; Deci and Ryan, 1985).	Intrapersonal
8	Risk-Taking	Hand to hand to decision- making is one's ability to deal with uncertainty and to take risks, as the results cannot be fully anticipated in most of circumstances (Hassi and Laursen, 2015; Shellman and Ewert, 2010; Sibthorp et al., 2007; Huff and Johnson, 1998; Brunson and Vogt, 1996)	Intrapersonal
9	Uncertainty		
10	Understand Business Environment	Houser and Frymier, 2009; Spreitzer, 1995; Zimmerman and Warschausky, 1998; Thomas and Velthouse, 1990;	Interactional
11	Understand the Problems at hand	Zimmerman, 1995, 2000; Spreitzer, 1995; Thomas and Velthouse, 1990;	Interactional
12	Understand Complexity by dealing with real situations	You, 2016; Hassi and Laursen, 2015; Houser and Frymier, 2009; Spreitzer, 1995; Lord and Hutchinson, 1993; Kieffer, 1984	Interactional
13	Teamwork		Interactional
14	Appreciate the Skills of Team Members	As appraising and making use of the resources at their disposal by collaborating with peers and bringing their skills into the decision-making process (Hassi and Laursen, 2015; Shellman and Ewert, 2010; Sibthorp et al., 2007; Huff and Johnson, 1998; Brunson and Vogt, 1996).	Interactional
15	Learn About Subject	Learn about the subjects in the learning context (You, 2016; Hassi and Laursen, 2015; Houser and Frymier, 2009; Weber et al., 2005; Lord and Hutchinson, 1993; Kieffer, 1984	Interactional
16	Influence	Hassi and Laursen, 2015; McQuillan, 2005; Zimmerman, 1995	Behavioural
17	Persuasive	Hassi and Laursen, 2015; McQuillan, 2005; Zimmerman, 1995	Behavioural
18	Leadership	Avramenko, 2012; Hassi and Laursen, 2015; Sibthorp and Arthur-Banning, 2004	Behavioural

Table 2. Observed variables. Source: Self-made.

3.2. Stage 2: Data Collection

Responses to the survey were collected using an anonymous online questionnaire. This approach ensured confidentiality while maximising accessibility for participants. The survey targeted students engaged in the business simulation, focusing on their experiences and perceptions of empowerment.

3.3. Stage 3: Data Analysis

The data were analysed using descriptive and inferential statistics to examine trends and validate the measurement instrument. A scale was developed to measure variables aligned with the three dimensions of PE, with reliability and validity assessments conducted as follows:

• Reliability Testing: Cronbach's Alpha coefficient was employed to ensure internal consistency of the scale.
• Validity Testing: Exploratory Factor Analysis (EFA) was utilized. EFA, a multivariate statistical procedure widely used in psychology and education (Hogarty et al., 2005), identifies relationships between observed variables and underlying latent factors (Nunnally and Bernstein, 1994; Bartholomew et al., 2011; Yong and Pearce, 2013). The responses to the survey were exported in formats compatible with the software package used for the analysis, Factor v12.04.04 (https://psico.fcep.urv.cat/utilitats/factor/Download.html).

3.4. Research Settings

The survey for this study was designed to capture students' perceptions of PE after participating in a dynamic and immersive educational experience: RETO 2024, a global business simulation competition organized by Company Game (https://www.retocompanygame.com/en/index24.html). The RETO 2024 competition is a yearly international event where students from universities across Europe and Latin America compete in teams to manage virtual companies across four categories: International Business, Marketing, General Management, and Finance.

The RETO 2024 employs business simulators that allow students to apply classroom knowledge in a risk-free, competitive environment, where they manage virtual companies across various industries, and compete with university teams globally, fostering collaboration and cultural exchange, whilst developing critical skills such as leadership, decision-making, and adaptability. Key performance metrics for RETO 2024 underscore its scale and impact: 2,550 students participated in the qualifying stage, with 1,571 advancing to the final competition; participants represent diverse educational backgrounds from 30 countries and 175 universities. The competition progresses through three phases:

1. Qualifying Phase: Teams compete against a simulator to achieve a minimum threshold score.
2. Category Phase: Teams compete against peers within their selected category.
3. Champion Phase: Top teams from each category face off in a surprise simulation to determine the ultimate champion.

The survey was implemented after the students completed Category Phase. The process ensured anonymity and voluntary participation and was administered from within the simulation platform. No personal information was collected to protect participants' identities.

4. Results

4.1. Descriptive Statistics of the survey's results

We have received 451 responses (response rate = 28.7%). No missing or incomplete data was present. Concerning the responses, out of a possible score of 5, the mean score for all the questions is 4.17, and the standard deviation is between 0.756 and 0.973. These results suggest that respondents scored above the middle range of the scale used (3 = neither agree nor disagree) (Table 3).

Variable	Mean	Variance	STD
1	3.989	0.570	0.7556374
2	4.144	0.656	0.8105305
3	4.146	0.639	0.8004741
4	4.115	0.643	0.8027791
5	4.038	0.688	0.8304740
6	4.022	0.758	0.8714971
7	4.173	0.618	0.7867090
8	4.215	0.723	0.8513224
9	4.370	0.615	0.7848026
10	4.111	0.684	0.8279247
11	4.377	0.634	0.7971061
12	4.118	0.680	0.8256601
13	4.231	0.687	0.8300170
14	3.978	0.944	0.9727147
15	4.275	0.652	0.8081623
16	4.233	0.635	0.7979895
17	4.228	0.584	0.7651822
18	4.282	0.601	0.7763694

Table 3. Descriptive Statistics. Source: Self-made.

Subsequently, we analyze the reliability of the scale by using Cronbach's Alpha coefficient, having a score of 0.9455, which is above the threshold of acceptable reliability (>0.7) (Nunnaly and Bernstein, 1994; Croasmun and Ostrom, 2011; Basto and Pereira, 2012). The sample size ensures a highly stable and precise estimate of Cronbach's Alpha. Therefore, the scale exhibits excellent internal consistency reliability, indicating that the items provide highly consistent responses across subjects.

4.2. Inferential Statistics

To perform factor analysis there must be univariate and multivariate normality within the data (Child, 2006;

Johnson and Wichern, 2007). However, this is not the case with Likert-type scales data which is not normally distributed, therefore, the polychoric correlations matrix should be used instead (Holgado-Tello et al., 2010). Polychoric correlation is advised when the univariate distributions of ordinal items are asymmetric or with excess kurtosis. If both indices are lower than one in absolute value, then Pearson correlation is advised.

Based on the data (See Table 4), polychoric correlation is recommended for the data used in this study.

The text included in the sections or subsections must begin one line after the section or subsection title. Do not use hard tabs and hard returns.

Variable	Mean	Confidence Interval 95%		Variance	Skewness	Kurtosis
1	3.989	(3.90	4.08)	0.570	-0.571	0.779
2	4.144	(4.05	4.24)	0.656	-0.595	-0.259
3	4.146	(4.05	4.24)	0.639	-0.817	0.777
4	4.115	(4.02	4.21)	0.643	-0.677	0.145
5	4.038	(3.94	4.14)	0.688	-0.608	0.078
6	4.022	(3.92	4.13)	0.758	-0.690	0.061
7	4.173	(4.08	4.27)	0.618	-0.727	0.377
8	4.215	(4.11	4.32)	0.723	-0.860	0.281
9	4.370	(4.28	4.46)	0.615	-1.392	2.422
10	4.111	(4.01	4.21)	0.684	-0.846	0.832
11	4.377	(4.28	4.47)	0.634	-1.336	1.991
12	4.118	(4.02	4.22)	0.680	-0.744	0.304
13	4.231	(4.13	4.33)	0.687	-0.967	0.643
14	3.978	(3.86	4.10)	0.944	-0.915	0.549
15	4.275	(4.18	4.37)	0.652	-1.021	0.841
16	4.233	(4.14	4.33)	0.635	-1.022	1.235
17	4.228	(4.14	4.32)	0.584	-0.831	0.567
18	4.282	(4.19	4.38)	0.601	-0.935	0.613

Table 4. Univariate Descriptives. Source: Self-made.

Univariate descriptive statistics reveal significant deviations from normality, with variables such as V9 (-1.392 skewness, 2.422 kurtosis) and V11 (-1.336 skewness, 1.991 kurtosis) exhibiting pronounced asymmetry and peakedness, while other variables show moderate skewness (e.g., V15, -1.021) and kurtosis near zero. Additionally, the determinant of the correlation matrix (< 0.000001) indicates high intercorrelations, while Bartlett's test of sphericity (χ^2 = 5102.1, p < 0.00001) confirms the matrix is factorable (Hair et al., 1995; Tabachnick and Fidell, 2007). The Kaiser-Meyer-Olkin (KMO) test score of 0.95645 (95% CI: 0.929–0.973) further supports the adequacy of the correlation matrix for analysis (Kaiser, 1974; Field, 2005).

The minimum level of the sample to the variable ratio (n:p) to achieve a good factor recovery was verified by employing Comrey (1978) and Comrey and Lee (1992)'s recommendations that for each variable that is subject to factor analysis, there should be between 5 and 10 observations. In our case, there are 18 variables (p) and the sample size is n=451, thus resulting in an n:p = 25.05(5) (Hair et al., 1995; Sapnas and Zeller, 2002).

We have also used the polychoric correlation covariance matrix (Table 5) (Flora and Curran, 2004) to identify linear relationships between variables, as well as evidence of singularity and multicollinearity (Gorsuch, 1990). When variables have correlation coefficients below 0.30, the literature recommends researchers reconsider applying factor analysis which is not the case (Tabachnick and Fidell, 2007).

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1																	
2	0.695	1																
3	0.554	0.617	1															
4	0.575	0.547	0.637	1														
5	0.519	0.555	0.606	0.592	1													
6	0.624	0.604	0.649	0.669	0.647	1												
7	0.573	0.556	0.714	0.662	0.578	0.666	1											
8	0.508	0.516	0.557	0.582	0.51	0.514	0.59	1										
9	0.571	0.608	0.554	0.594	0.491	0.548	0.616	0.696	1									
10	0.569	0.634	0.611	0.633	0.615	0.642	0.629	0.533	0.646	1								
11	0.528	0.614	0.472	0.494	0.549	0.492	0.515	0.446	0.63	0.644	1							
12	0.611	0.626	0.676	0.683	0.685	0.704	0.719	0.548	0.585	0.737	0.576	1						
13	0.506	0.542	0.538	0.553	0.543	0.566	0.583	0.531	0.61	0.623	0.609	0.658	1					
14	0.436	0.466	0.444	0.451	0.453	0.519	0.445	0.435	0.523	0.484	0.463	0.539	0.513	1				
15	0.538	0.494	0.548	0.567	0.541	0.524	0.649	0.523	0.605	0.596	0.577	0.584	0.712	0.491	1			
16	0.555	0.57	0.649	0.624	0.562	0.627	0.636	0.577	0.611	0.621	0.597	0.67	0.591	0.471	0.621	1		
17	0.52	0.54	0.62	0.623	0.582	0.649	0.657	0.632	0.613	0.648	0.49	0.677	0.589	0.48	0.607	0.722	1	
18	0.595	0.611	0.666	0.611	0.547	0.627	0.659	0.729	0.672	0.708	0.561	0.682	0.57	0.477	0.636	0.739	0.764	1

Table 5. Standardized Variance/Covariance matrix. Source: Self-made.

The Item Location and Item Adequacy Indices also show that the items are well-suited for inclusion in the factor structure. The high discrimination and sampling adequacy indices, along with stable bootstrap confidence intervals, suggest that the scale is robust, reliable, and well-designed for measuring the intended constructs (See Table 6).

Variable	QIM	RDI	Normed	MSA	Bootstrap Confidence Interval 95%	
1	14	1	0.74446	0.97567	(0.904	0.978)
2	1	1	0.74723	0.95839	(0.894	0.969)
3	6	1	0.75554	0.96576	(0.899	0.971)
4	5	1	0.75942	0.95575	(0.858	0.971)
5	10	2	0.77772	0.96500	(0.898	0.971)
6	4	2	0.77882	0.97759	(0.917	0.978)
7	12	2	0.77938	0.95788	(0.885	0.967)
8	2	2	0.78603	0.95498	(0.889	0.963)
9	3	2	0.78659	0.96513	(0.890	0.968)
10	7	2	0.79324	0.95787	(0.881	0.969)
11	8	2	0.80377	0.92559	(0.837	0.946)
12	17	2	0.80710	0.96921	(0.900	0.974)
13	13	2	0.80765	0.94681	(0.872	0.958)
14	16	2	0.80820	0.96901	(0.907	0.974)
15	15	2	0.81874	0.93576	(0.848	0.953)
16	18	2	0.82040	0.93735	(0.862	0.949)
17	9	3	0.84257	0.95570	(0.885	0.966)
18	11	3	0.84424	0.94564	(0.852	0.961)

Table 6. Item Location and Item Adequacy Indices. Source: Self-made.

The choice of a one-factor solution is, in principle, supported by the explained variance and eigenvalue results (See Table 7).

Variable	Eigenvalue	Proportion of Variance	Cumulative
1	11.02029	0.61224	0.61224
2	0.825800	0.04588	0.65812
3	0.78388	0.04355	0.70167
4	0.68011	0.03778	0.73945
5	0.60766	0.03376	0.77321
6	0.50602	0.02811	0.80132
7	0.46499	0.02583	0.82715
8	0.40783	0.02266	0.84981
9	0.40297	0.02239	0.87220
10	0.37237	0.02069	0.89289
11	0.32777	0.01821	0.91110
12	0.30544	0.01697	0.92807
13	0.27962	0.01553	0.94360
14	0.25527	0.01418	0.95778

Variable	Eigenvalue	Proportion of Variance	Cumulative
15	0.23616	0.01312	0.97090
16	0.21188	0.01177	0.98267
17	0.17267	0.00959	0.99226
18	0.13928	0.00774	1.00000

Table 7. Explained Variance Based on Eigenvalues. Source: Self-made.

The first factor has an eigenvalue of 11.02, which is well above the threshold of 1 typically used to determine factor retention under the Kaiser Criterion. This factor alone explains 61.2% of the total variance, indicating that it captures the majority of the shared variability among the variables. In contrast, the second factor has an eigenvalue of just 0.83, accounting for only 4.6% of the variance, and subsequent factors contribute progressively smaller proportions (Horn, 1965; Velicer and Jackson, 1990; Costello and Osborne, 2005). This steep drop in eigenvalues after the first factor often referred to as the elbow in a scree plot, suggests that additional factors are unlikely to represent meaningful dimensions and instead reflect noise or minor variance (Cattell, 1966).

The results of the Parallel Analysis (Table 8) based on Minimum Rank Factor Analysis provide evidence for the retention of a single factor. In this method, the variance explained by the factors derived from the real data is compared against the variance from 500 random datasets, focusing on the mean and the 95th percentile of the random variances. The first factor in the real data explains 65.26% of the variance, far exceeding both the mean of random variance (11.23%) and the 95th percentile of random variance (12.73%), confirming its statistical significance and importance.

Variable	Real-data	Mean of Random	95 percentile of random
	% of Variance	% of Variance	% of Variance
1	65.2641	11.2294	12.729
2	4.7007	10.3383	11.4635
3	4.4179	9.6418	10.6764
4	3.7879	8.9555	9.7411
5	3.4670	8.3141	8.9846
6	2.6749	7.6954	8.3342
7	2.5484	7.0483	7.6346
8	2.3199	6.4439	6.9694
9	1.9998	5.8392	6.4220
10	1.8940	5.2116	5.7910
11	1.5562	4.6172	5.2385
12	1.4344	4.0078	4.6570
13	1.2778	3.3863	4.1284
14	1.0270	2.7695	3.4812
15	0.8823	2.1450	2.9276
16	0.6308	1.5229	2.3337
17	0.1168	0.8337	1.5033

Table 8. Parallel Analysis Based on Minimum Rank Factor Analysis. Source: Self-made.

In contrast, the second factor explains only 4.70% of the variance, which falls below the 95th percentile of random variance (11.46%). Similarly, all subsequent factors explain progressively less variance, none exceeding their respective random thresholds. This demonstrates that the additional factors likely reflect noise or minor variations rather than substantive dimensions.

The unrotated loading matrix and communalities can be seen below (Table 9).

Variable	F1	Communality
1	0.725	0.525
2	0.749	0.562
3	0.779	0.606

Variable	F1	Communality
4	0.777	0.603
5	0.733	0.538
6	0.790	0.624
7	0.806	0.649
8	0.722	0.522
9	0.779	0.607
10	0.815	0.664
11	0.706	0.498
12	0.847	0.717
13	0.753	0.567
14	0.613	0.376
15	0.751	0.564
16	0.805	0.648
17	0.804	0.646
18	0.839	0.704

Table 9. Unrotated Loading Matrix – 1 factor. Source: Self-made.

The loadings for the first factor (F1) are relatively high across most variables, with the majority showing values above 0.7, such as V12 (0.847) and V10 (0.815), indicating a strong relationship with the underlying construct. However, certain variables, such as V14 (0.613) and V11 (0.706), exhibit weaker loadings, suggesting they may not align as strongly with the dominant factor. The communalities, which measure the proportion of each variable's variance explained by the factor(s), show a similar pattern. While variables like V12 (0.717) and V10 (0.664) have high communalities, indicating that most of their variance is explained by a single factor, others like V14 (0.376) and V11 (0.498) have lower communalities, suggesting some of their variance remains unexplained. This residual variance implies that additional dimensions may exist, capturing unique aspects of these variables that are not fully accounted for by a one-factor solution. This pattern points to potential multidimensionality in the data. Thus, a single-factor solution, while capturing a significant portion of the variance, may oversimplify the structure, especially if some variables are influenced by additional latent constructs. Therefore, extracting two factors could better capture the complexity of the data, redistributing the variance and clarifying the relationships among variables. For instance, variables with weaker loadings and communalities in the one-factor model may load more strongly on a second factor, reflecting a distinct subdimension (See Table 10).

Variable	F1	F2	Communality
1	0.724	0.002	0.524
2	0.749	0.057	0.564
3	0.782	-0.234	0.667
4	0.778	-0.157	0.629
5	0.733	-0.099	0.547
6	0.793	-0.222	0.678
7	0.807	-0.154	0.675
8	0.721	0.023	0.521
9	0.783	0.239	0.670
10	0.814	0.054	0.666
11	0.713	0.330	0.617
12	0.847	-0.129	0.734
13	0.756	0.218	0.618
14	0.613	0.105	0.387
15	0.753	0.179	0.599
16	0.804	-0.018	0.647
17	0.803	-0.095	0.654
18	0.838	-0.014	0.702

Table 10. Unrotated Loading Matrix – 2 factors. Source: Self-made.

Although the results so far seem to indicate a departure from this initially devised theoretical structure - which would be theoretically more aligned with a three-factor structure as per the three dimensions

intrapersonal, interactional, and behavioural - still provides support for a two-factor solution. Furthermore, theoretical considerations argue against collapsing PE into a single dimension:

• The interactional dimension captures unique analytical and contextual processes that are not sufficiently explained by a single overarching factor.
• A two-factor model provides a more nuanced understanding of PE, differentiating between the internal and external facets of empowerment. This differentiation is crucial for designing interventions and evaluating outcomes in educational contexts.

The extraction of two factors will be performed using Unweighted Least Squares (ULS) due to its suitability for the dataset and its statistical advantages. ULS is particularly well-suited for analyses involving ordinal data and polychoric correlation matrices, as it does not rely on the assumption of multivariate normality. In the dataset, all the variables accounted for communalities greater than 0.30, so we have decided to keep them all (Child, 2006; Kline, 2014) (Table 10).

The literature suggests that orthogonal rotation methods should be applied if factors are expected to be uncorrelated, whereas if not, oblique rotation methods should be used instead. Certainly, in social sciences, some correlation among factors is expected since human behaviour "is rarely partitioned into neatly packaged units that function independently of one another" (Costello and Osborne, 2005, p.3). Thus, we have chosen the direct oblimin/ oblique rotation method (See Table 11).

Variable	F1	F2
Resilience	**0.481**	0.272
Reflective Ability	**0.404**	0.38
Ability to Work Independently	**0.922**	-0.13
Competitive Abilities	**0.787**	0.008
Creativity	**0.659**	0.094
Motivation for learning	**0.908**	-0.104
Decision-Making	**0.802**	0.023
Risk-Taking	**0.444**	**0.308**
Uncertainty	0.118	**0.717**
Understand Business Environment	**0.454**	**0.397**
Understand Problems at hand	-0.083	**0.854**
Understand Complexity by dealing with real situations	**0.786**	0.083
Teamwork	0.136	**0.669**
Appreciate Skills of Team Members	0.233	**0.414**
Learn About Subject	0.2	**0.599**
Influence	**0.569**	0.266
Persuasive	**0.699**	0.127
Leadership	**0.585**	0.284

Table 11. Rotated Loading Matrix. Source: Self-made.

A general rule to determine the reliability of the factors extracted is to look at the relationship between the factor loadings and the magnitude of the absolute sample size (Costello and Osborne, 2005; Henson and Roberts, 2006; Child, 2006; Kline, 2014). Therefore, we have analysed the results applying initially a cut-off for loadings below 0.30 (highlighted in bold).

The results of the analysis offer valuable insights into the factor model's structure, reliability, and relationships. The rotated factor solution reveals that Factor 1 explains a substantial amount of variance (7.136 units), indicating its prominence in capturing the shared variance among the variables. Factor 2, while explaining less variance (3.962 units), still contributes meaningfully to the model, suggesting the presence of a distinct yet related dimension. Together, these factors represent the multidimensional structure of the data (Fernando and Lorenzo-Seva, 2016) (See Table 12).

Factor	Variance	ORION	Factor Determinacy Index
1	7.136	0.952	0.976
2	3.962	0.909	0.953

Table 12. Explained Variance of Rotated Factors and Reliability of Phi-Information Oblique EAP Scores. Source: Self-made.

The reliability of the factor scores, as measured by the Overall Reliability of fully-Informative prior Oblique N-EAP scores (ORION), is high for both factors, with values of 0.952 (Factor 1) and 0.909 (Factor 2). These scores confirm that the factor estimates are robust and consistent. Additionally, the Factor Determinacy Index values, which indicate the accuracy of the factor score estimation, are also strong for both factors (0.976 for Factor 1 and 0.953 for Factor 2). These metrics collectively demonstrate that the extracted factors are reliable and can be interpreted with confidence.

The inter-factor correlation matrix reveals a strong positive correlation (0.837) between the two factors, indicating that they are related yet distinct dimensions of the underlying construct. This suggests that while the factors share some common variance, each captures unique aspects of the data, supporting a two-factor solution (See Table 13).

Factor	F1	F2
1	1	
2	0.837	1

Table 13. Inter-Factors Correlation Matrix. Source: Self-made.

The structure matrix (See Table 14) highlights the relationships between the variables and the factors. Many variables load strongly on both factors (e.g., V10: 0.786 on Factor 1 and 0.777 on Factor 2, and V9: 0.718 on Factor 1 and 0.816 on Factor 2), reflecting the interconnectedness of the factors. However, some variables demonstrate stronger associations with one factor over the other, indicating that each factor represents a distinct dimension within the data. For instance, V12 has a higher loading on Factor 1 (0.856) compared to Factor 2 (0.741), while V11 shows a stronger association with Factor 2 (0.784) than Factor 1 (0.632).

Variable	F1	F2
1	0.708	0.674
2	0.722	0.718
3	0.813	0.642
4	0.793	0.666
5	0.738	0.646
6	0.821	0.656
7	0.821	0.694
8	0.702	0.680
9	0.718	0.816
10	0.786	0.777
11	0.632	0.784
12	0.856	0.741
13	0.696	0.783
14	0.579	0.609
15	0.701	0.766
16	0.791	0.742
17	0.806	0.712
18	0.823	0.774

Table 14. Structure Matrix. Source: Self-made.

The analysis supports a two-factor model, with both factors contributing meaningfully to the variance and providing reliable, interpretable dimensions. The high inter-factor correlation suggests that the factors are

closely related but not redundant, allowing for a more nuanced understanding of the underlying construct. This reinforces the appropriateness of retaining two factors to capture the multidimensional nature of the data.

5. Discussion

The theoretical foundation of this study was built on the premise that PE is a multidimensional construct encompassing three distinct dimensions: intrapersonal, interactional, and behavioural. The results challenged this tripartite framework, demonstrating that the data align more closely with a two-factor structure. The empirical evidence revealed that variables associated with intrapersonal and behavioural characteristics were highly intercorrelated, suggesting that these two dimensions are not distinct in practice. Instead, they converge into a single, unified factor that reflects both the cognitive foundations of empowerment, such as motivation and self-efficacy, and the behavioural manifestations, such as decision-making, leadership, and teamwork. In contrast, the interactional dimension emerged as distinct and separable from the other two. This dimension retained its unique focus on analytical skills, contextual engagement, and problem-solving. It reflects how individuals analyze their environments, navigate complexities, and leverage resources to exert influence. These qualities are qualitatively different from the cognitive-behavioural aspects of empowerment, justifying their preservation as a separate factor.

One of the key advantages of this two-factor model lies in its ability to streamline the construct of PE without losing its conceptual richness. By consolidating the intrapersonal and behavioural dimensions, the model acknowledges the natural interdependence between internal self-perceptions and external behaviours. This integration simplifies the interpretation of PE while preserving its core attributes, making it more accessible for researchers and practitioners alike. For instance, this approach emphasizes how motivation and self-efficacy are not abstract qualities but directly influence tangible outcomes such as leadership, decision-making, and teamwork. This alignment strengthens the practical relevance of the model, particularly in educational and professional contexts, where the translation of beliefs into actions is critical.

5.1. Limitations of the research

However, despite these strengths, the results of the study also present limitations that warrant consideration. The shift from a three-factor to a two-factor model, while empirically justified, represents a departure from the theoretical framework that informed the initial design of the research instrument. This adjustment necessitates a reinterpretation of the original constructs, which may not fully capture the nuances intended by the three-dimensional model. For instance, the merging of intrapersonal and behavioural dimensions could obscure subtle differences between self-perception and action, potentially oversimplifying the construct.

Moreover, the reliance on EFA to determine the factor structure, while appropriate for a newly developed instrument, has inherent limitations. EFA is data-driven and may reflect the characteristics of the specific sample rather than the broader population. The findings, therefore, need to be validated through confirmatory factor analysis or replication in different contexts to ensure their generalizability. The strong emphasis on statistical criteria, such as eigenvalues and explained variance, may also overshadow qualitative aspects of PE that are not easily captured through quantitative methods.

Another limitation concerns the scope of the sample, which, while sufficient for statistical analysis, is contextually tied to a specific educational setting - namely, students participating in the RETO 2024 business simulation competition. While this context provides a rich and relevant backdrop for studying empowerment, the results may not fully translate to other educational or professional settings, particularly those that do not emphasize experiential or competitive learning.

Finally, the consolidation of dimensions into a two-factor model reduces the granularity of the construct. The three-factor model offered a more detailed perspective, potentially enabling a finer differentiation between the cognitive, social, and behavioural aspects of empowerment. By moving to a two-factor structure,

some of this granularity is inevitably lost, which could limit the applicability of the model in contexts where a more nuanced understanding of PE is required.

6. Conclusions

This study set out to validate a three-dimensional framework of PE, encompassing intrapersonal, interactional, and behavioural dimensions, through EFA. However, the empirical results led to a significant refinement of the theoretical model, supporting a two-factor solution instead. The data strongly suggest that the intrapersonal and behavioural dimensions are not empirically distinct but rather converge into a unified factor which reflects the seamless transition from self-perceptions and motivation to observable actions such as decision-making and leadership. Meanwhile, the interactional dimension retains its distinctiveness, emphasizing analytical and contextual engagement, such as problem-solving and resource management, which are not subsumed within the cognitive-behavioural factor.

Ultimately, this study provides a significant contribution to the conceptualization and measurement of psychological empowerment, offering a revised two-factor framework that reconciles theoretical expectations with empirical evidence. The findings lay a robust foundation for future research while underscoring the need for continued exploration and refinement of the scale to ensure its applicability and effectiveness in fostering empowerment across varied settings.

Funding

Appendix 1

Reflect on your experience:

1. How well did you bounce back from setbacks encountered while managing your virtual business in RETO 2014?
2. How comfortable are you now reflecting on decisions you made during the RETO 2014 challenge and learning from them?
3. How confident are you in your ability to work independently after your experience in RETO 2014?
4. How well do you think you performed in coming up with creative solutions to problems faced while managing your virtual business in RETO 2014?
5. How comfortable were you taking calculated risks when making decisions for your virtual business in RETO 2014?
6. How well did you feel prepared to handle situations with a high level of uncertainty while managing your virtual business in RETO 2014?
7. How confident are you now in your decision-making skills after facing challenges during the RETO 2014 virtual business challenge?
8. How strong do you feel your competitive abilities have improved?
9. How motivated have you been to learn more about the business concepts covered in the competition?
10. How well do you feel you understood the simulated business environment after participating in the RETO 2014 challenge?
11. Do you believe the simulation was a helpful tool for understanding the types of problems faced in real-world businesses?
12. How confident are you in your ability to navigate the complexities of a business scenario?
13. How well do you think you can learn effectively with your teammates and appreciate their skills?
14. How likely are you to seek additional information and resources to support a business decision?
15. How well do you feel you worked effectively as part of a team while managing your virtual business in RETO 2014?
16. To what extent do you feel you were able to influence the decisions made by your team while managing

your virtual business in RETO 2014?

17. How confident are you now in presenting persuasive arguments after your experience managing a virtual business in RETO 2014?

18. Did you have the opportunity to demonstrate leadership skills while managing your virtual business in RETO 2014? If so, how well do you feel you performed?

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