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THE INTERCONNECTEDNESS OF PROFESSIONAL COMPETENCIES: A BAYESIAN ORDINAL CORRELATION AND HIERARCHICAL CLUSTERING ANALYSIS OF OJT SUPERVISOR EVALUATIONS

Montano Vicente, Gabronino Rosalia and Mercado Joannalynn
College of Business Administration Education, University of Mindanao
Email: vicente_montano@umindanao.edu.ph; + (63)9094177626
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Abstract: This research investigates supervisor evaluations of Business Administration OJT students in four programs—Human Resource Management, Business Economics, Marketing Management, and Financial Management—and nine professional competencies. The analysis of ratings indicated overall high performance, with essential associations between the program and the seven competencies. Bayesian ordinal correlation analysis indicated strong competency relationships, particularly between Leadership and Excellence (0.76), honesty and integrity and teamwork (0.75), and professionalism and honesty and integrity (0.73). Three competency clusters were identified: character-collaborative attributes, performance-related skills, and developmental foundations, with Innovation emerging independently. Findings indicate that students generally meet professional expectations but require targeted curriculum improvements to enhance innovation skills and capitalize on character-based competency interconnections for integrated development.

Keywords: Competency-based education, Business administration internships, Supervisor evaluations, Bayesian ordinal correlation, Professional skill development

INTRODUCTION

On-the-job Training (OJT) programs are a vital bridge between academic studies and professional practice for business administration students (Tolentino, 2023). These guided experiences allow students to implement theoretical knowledge in practice and develop the critical professional skills that employers require. With increasing pressure on higher education institutions to demonstrate their graduates' employability (Valdez et al., 2015), assessing the quality of OJT programs, most importantly through supervisor ratings, has become crucial to enhancing curricula and program outcomes (Bender, 2021). Supervisor ratings of students' competencies give direct feedback on how practical academic training relates to workplace demands and indicate areas for additional educational assistance is required (McDonough et al., 2009).

Business administration involves a range of programs, each with unique competency requirements (Azevedo et al., 2012). Human Resource Management emphasizes people and ethical competencies; Business Economics focuses on analysis and strategic thinking; Marketing Management calls for creativity and customer orientation; and Financial Management necessitates accuracy and solid analytical capabilities. Nevertheless, specific core

competencies are universal to all programs (Gilyazova & Zamoshchansky, 2022). Understanding how these competencies operate across various fields enables institutions to more effectively adapt their programs to satisfy generic and program-specific industry requirements (Miterev et al., 2016).

Supervisor ratings provide a practical, out-of-class picture of student performance that can be lost with more conventional classroom evaluations. Students must handle interpersonal dynamics at work, adjust to firm cultures, and make meaningful contributions (Liu et al., 2011). Trends in supervisor ratings can identify areas of strength and weakness in student readiness and identify disconnects between academic instruction and work requirements (Tan et al., 2023). Observing how skills are related can also inform more cohesive professional development programs that account for the interrelatedness of skills (Patrick et al., 2020).

This research examines supervisor ratings of Business Administration OJT students in four programs and nine professional competencies. Specifically, the study seeks to (1) assess the general distribution of ratings to measure overall performance, (2) test if there are significant correlations between program and competency ratings, (3) find correlations between competencies to identify skill clusters, and (4) recommend curriculum enhancements based on the results. Ultimately, the aim is to produce actionable insights that will enable business programs to better prepare students for success in various professional environments.

LITERATURE REVIEW

This research establishes its theoretical underpinnings on competency-based education and workplace learning theories to explain how professional competencies evolve through On-the-Job Training (OJT). Competency-based education theory, developed by researchers like McClelland and Boyatzis, defines professional development as learning measurable, observable skills and qualities for effective performance in given environments (Epikhin et al., 2023), (Mahajan & Chowdhary, 2019). Competencies are seen not as isolated skills but as holistic sets of knowledge, abilities, and behaviors that, in combination, promote professional achievement (Beckett, 2008). Transposed to business administration OJT courses, the model implies that student performance should be measured in terms of technical skills, interpersonal skills, ethical behavior, and metacognitive abilities (Beard, 2007). The nine competencies tested in this study—Professionalism, Job Maturity, Communication Skills, Productivity, Leadership, Excellence, Honesty and Integrity, Innovation, and Teamwork—reflect this wide-ranging, multidimensional conception of professional capability.

This research also builds upon situated learning theory, most notably the contributions of Lave, J., & Wenger, E. (1991), which assumes that learning occurs through membership in communities of practice. In this view, competency building originates from students' step-by-step participation in actual professional practices by experienced practitioners (Hargreaves & Gijbels, 2012). OJT schemes are thus designed as experiences of genuine, situated learning where students develop competencies by being exposed to real-life workplace settings (Hamman-Fisher & McGhie, 2021). These differences in competency ratings by program can reflect differences in the communities of practice that students enter, each with its norms, values, and performance expectations. The chi-square tests of the association between program and competency ratings are employed to reveal the context effects on learning.

Correlational analysis among competencies is based on holistic professional growth models (Golden & Brown, 2017), specifically Bandura's social cognitive theory, which emphasizes the interaction among personal factors, behaviors, and environmental conditions (Bandura, 2001). This explains why some competencies are likely to grow together. For example, the high correlations between character-based competencies such as honesty and

integrity, teamwork, and Professionalism probably stem from psychological mechanisms beneath them, whereby improvement in one characteristic facilitates improvement in related traits. Expectancy value theories of motivation also propose that students allocate effort in areas in which they value and believe they can succeed, resulting in clusters of mature competencies (Wigfield & Eccles, 2000). The use of Bayesian ordinal correlation analysis in this study is to chart these patterns and to determine how professional competencies develop as interlinked systems and not as distinct items.

METHODS

This research used a descriptive research design program to formally record and compare OJT supervisors' judgments of trainees' professional competencies. A descriptive method was proper, as the main aim was to count and summarize the supervisors' assessments without changing any variables or identifying causal connections. Because of the concern about naturally occurring ratings, the design allowed an objective and truthful representation of the trainees' perceived performance within several competency areas (McDonough et al., 2009). The program instrument was a structured rating scale questionnaire designed for this evaluation. The study assessed the nine most important competencies for professional success: Professionalism, job maturity, communication skills, productivity, leadership, excellence, honesty and integrity, innovation, and teamwork. Each competency was rated on a five-point Likert-type ordinal scale, ranging from Very Low (1) to Very High (5). The instrument is a university-standardized instrument, which, before deployment, underwent a pilot test with a small subset of supervisors to assess its clarity, relevance, and reliability. The questionnaire demonstrated acceptable internal consistency, as evidenced by the Cronbach's alpha coefficient exceeding the standard threshold of 0.70. Content validity was established through expert review, where academic and industry practitioners assessed the appropriateness and coverage of competencies and rating descriptors.

The respondents were OJT supervisors who directly supervised the trainees during their field placement. Based on the university's Memorandum of Agreement (MOA) with the Host Training Establishments (HTEs), supervisors were selected to engage with the OJT program actively. They had a direct supervisory relationship with the trainees. Their closeness to the trainees' day-to-day work activities placed them in the best position to provide valid and reliable assessments of the competency areas under focus (Gonsalvez & Freestone, 2007). The participation was voluntary, and supervisors were informed of the reasons for the evaluation to ensure honest and objective feedback in compliance with the CHED CMO No. 104 series 2017.

The research used the Bayesian Ordinal Correlation analysis program to test the correlations between the nine professional competencies rated by OJT supervisors. Since the data were obtained through an ordinal Likert-type scale, Bayesian Ordinal Correlations were used to appropriately capture the built-in order of the data as well as account for uncertainty and possible non-linearity among the variables (Kottas et al., 2005; Luo et al., 2021).

Bayesian approaches can supply a complete posterior distribution of the correlation coefficients rather than a point estimate. This enables a more detailed interpretation of the strength and direction of relationships (Chen & Dey, 2000) among competencies in probabilistic terms rather than frequentist significance testing. By this method, the study estimated how likely it was that skills like professionalism, leadership, honesty, and integrity were positively correlated, according to the supervisors' ratings. Significantly, the Bayesian model permitted the study to create credible intervals, providing a probabilistic range over which the actual correlation is likely to lie instead of depending exclusively on arbitrary p-value cutoffs (DeYoreo & Kottas, 2018).

Applying Bayesian Ordinal Correlations also fits the study's focus on strong, assumption-sensitive statistical techniques. By not depending on large-sample approximations and limiting distributional assumptions, this method enhanced the validity of the inferences, especially considering the ratings' ordinal, non-normally distributed character (He, 2022). In addition, the Bayesian approach improved the interpretation of results by enabling direct probabilistic (Bypaneni et al., 2018) statements, i.e., "there is a 95% probability that there is a moderate to strong correlation between Innovation and Communication Skills," instead of indirect null hypothesis rejections.

In general, Bayesian Ordinal Correlation analysis enriched the study by presenting a formal and suitable statistical model to investigate how various professional abilities relate to one another, providing more insightful views into the tendencies of supervisor ratings than traditional methods were able to provide.

For the additional program statistical methods program, descriptive statistics, such as frequency distributions and cross-tabulations, were used to describe the ratings for each competency at all ordinal levels. Both competency and rating level totals were calculated to obtain more general views of the evaluation patterns. A visual heatmap and hierarchical clustering (dendrogram) were used to explore the relationship between competencies. These sophisticated descriptive methods enabled the detection of similarly rated competency clusters, offering insight into patterns of collective strength or possible variability within trainees. The statistical treatment was designed in sync with the study's goal to yield an unambiguous, fact-based picture of trainees' levels of professional competency as rated by their supervisors.

RESULTS AND DISCUSSIONS

Table 1 presents the spread of OJT supervisors' ratings over the following nine professional competencies: professionalism, job maturity, communication skills, productivity, leadership, excellence, honesty, integrity, innovation, and Teamwork. Ratings were grouped into five ordinal levels: Very Low (1), Low (2), Moderate (3), High (4), and Very High (5). The "Total" column sums ratings of overall competencies at each level, whereas the "Total" row totals ratings over each competency.

Table 1. Business Administration OJT Supervisors' Rating Distribution

	Professionalism	**Job Maturity**	**Communication Skills**	**Productivity**	**Leadership**	**Excellence**	**Honesty and Integrity**	**Innovation**	**Teamwork**	**Total**
Very Low (1)	-	-	-	-	-	-	-	-	-	-
Low (2)	-	1	-	-	1	1	-	1	-	4
Moderate (3)	4	4	6	7	10	6	6	13	7	63
High (4)	43	53	67	41	79	71	36	72	38	500
Very High (5)	112	101	86	105	69	81	117	73	113	857
Total	159	159	159	153	159	159	159	159	158	1424

As a whole, supervisor ratings tend to be strongly positive. Most ratings were "High" and "Very High" for all competencies. Professionalism, for instance, received 43 "High" and 112 "Very High" ratings, and Honesty and Integrity received 36 "High" and 117 "Very High" ratings. Conversely, "Very Low" and "Low" ratings barely exist, with only four total "Low" ratings and no "Very Low" ratings. The "Moderate" level scores suggest a little more variation — e.g., Innovation had 13 "Moderate" scores—but are still a tiny percentage overall.

The "Total" column attests to this pattern: 857 ratings fell into the "Very High," 500 into the "High," and only 63 into the "Moderate." The low numbers in the "small" (4 ratings) and "Very Low" (0 ratings) columns underscore the positive reviews. The "Total" row shows that rating tallies per competency were roughly the same, about 159 each, with slight variations (e.g., Productivity had 153 and Teamwork had 158).

Generally speaking, the table indicates that OJT trainees are uniformly seen to have a high to very high level of competence in all competency areas, with almost all ratings suggesting that they are excellent.

This analysis employed Bayesian ordinal correlations (suitable for Likert-scale OJT ratings) to investigate how various competencies correlate. In Figure 1, all the correlations are positive, ranging from moderate to very high; thus, students who excel in one area tend to excel in others.

The Bayesian Ordinal Correlation Matrix of OJT competencies shows a generally strong correlation of key professional attributes. Within the context of program competency-based education theory, this high degree of interrelation upholds the principle that competencies are not discrete entities but clusters of quantifiable and mutually reinforcing skills (Lu et al., 2025). Notably, program professionalism exhibited extremely high correlations with program honesty and integrity (0.73) and program teamwork (0.69) and high correlation with program productivity (0.71). These results confirm that the key behavioral characteristics at the core of employability and job performance evolve concurrently, supporting the theory that OJT programs must concentrate on integrated competency models instead of addressing each skill as a distinct outcome.

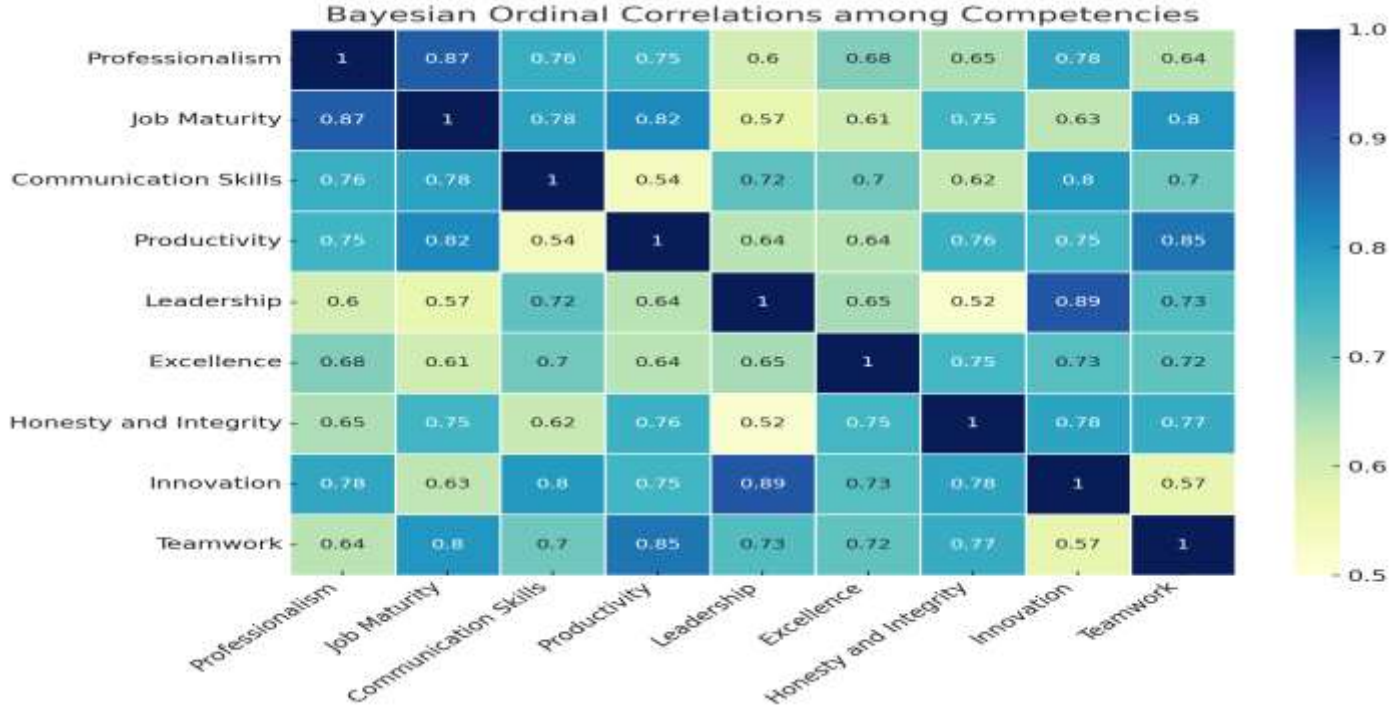
From the learning theory perspective, the correlations imply that competencies are developed and reinforced through genuine engagement in workplace tasks (Noe et al., 2010). The high correlation between leadership and excellence (0.76) indicates that leadership behaviors are best developed in real-world, performance-based environments where excellence is required and exemplified. This is consistent with the theory's contention that learning is social and context-specific (Truskanov et al., 2018). Similarly, the high correlation between program communication and job maturity (0.63) and between productivity and communication (0.62) speaks to how exposure to authentic communication requirements on the job scaffolds more general professional growth, as opposed to such skills arising from strictly academic training.

The matrix shows how reinforcement loops work from the viewpoint of workplace learning theories and experiential and informal learning theories. Supervisors and colleagues modeling professionalism likely reinforce behaviors related to honesty, teamwork, and productivity simultaneously. This interconnected reinforcement helps explain why specific competencies (e.g., professionalism, honesty & integrity, teamwork) show stronger internal cohesion than others (e.g., innovation), which presents lower correlations across the board (e.g., 0.39 with productivity, 0.41 with communication). More conservative correlations for innovation imply that innovative skills require more intentional, albeit less environment-assisted, support than behavioral skills, which thrive organically in formal working environments.

The matrix is consistent with program holistic professional growth models, which state that effective professional development is cognitively, socially, emotionally, and ethically integrated. The strong correlation between

program honesty and integrity, as well as program teamwork (0.75), demonstrates that the ethical and social dimensions are growing side-by-side. Likewise, the pattern of high correlations among professionalism-related characteristics suggests that developing a well-rounded professional self-awareness requires multi-aspect development rather than linear skill development. Notably, innovation emerges as a competency that, although related, is more specific—again, in keeping with holistic approaches where it is acknowledged that some traits (notably creative and change-oriented) require specialized developmental interventions.

The Bayesian correlation matrix aligns with the theoretical argument that professional competences develop through dynamically changing, socially embedded, and integrated learning experiences throughout OJT. Additionally, it enhances the point that curriculum development must not treat competency in silo: instead, taking advantage of their natural inter-development while still recognizing and enhancing additional support on competencies such as program innovation whose development does not come so simply through mere exposure. OJT programs that make their design systematic based on these observations, emphasizing supporting competency clusters and specifically targeting less naturally emerging competencies, are most likely to yield truly workplace-ready graduates.



Correlation strength interpretation:

0.701.00: Strong positive correlation

0.500.69: Strong positive correlation

0.300.49: Moderate positive correlation

0.100.29: Weak positive correlation

0.000.09: Negligible correlation

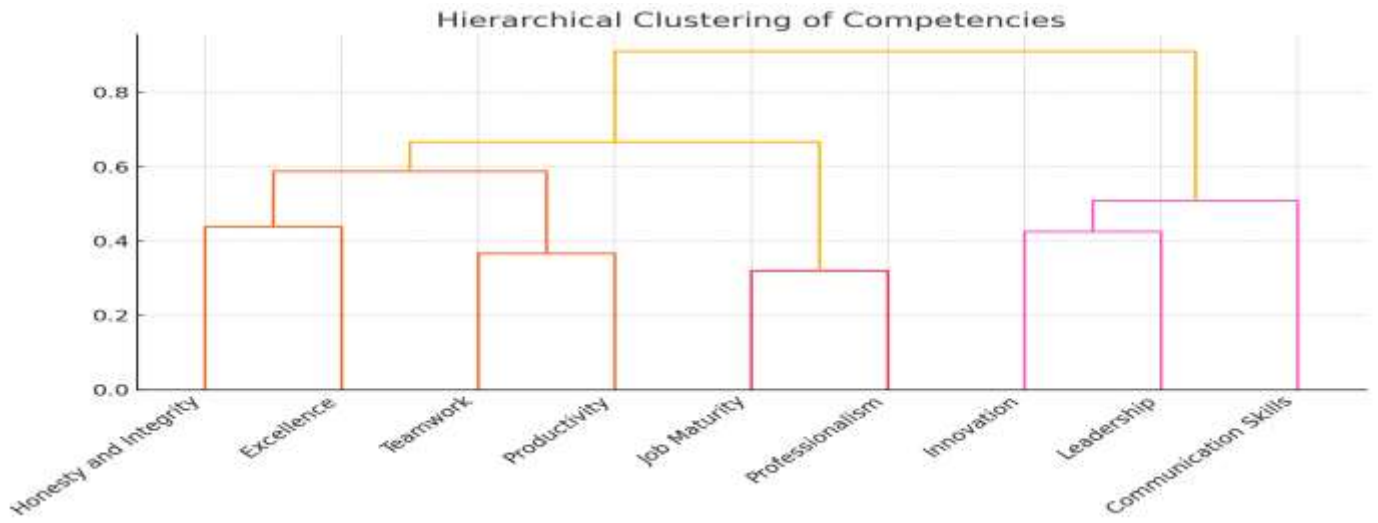


Figure 1. Bayesian Ordinal Correlation Heat Map and Hierarchical Clustering of Competencies

The patterns of relationships between the nine professional competencies were analyzed using Bayesian ordinal correlations, graphically represented using a heatmap, and hierarchical clustering based on dendrogram analysis. Uniformly strong positive correlations between all competencies were observed from the heatmap, and correlation coefficients mainly fell between 0.60 and 0.90. This pattern suggests that OJT supervisor's rate multiple competencies as highly correlated, implying that trainees who perform well in one competency are typically rated performing well in others.

Hierarchical clustering using a dendrogram provided additional insights into the structure of these competencies. The cluster structure revealed natural groupings by similarities in supervisors' rating patterns. Professionalism, leadership, honesty, and integrity are of particular interest, and they are clustered separately, suggesting that these factors are commonly assessed together and perhaps tap a similar underlying construct of professional and ethical behavior. Similarly, communication skills, productivity, and teamwork were clustered, suggesting that supervisors consider interpersonal competence and collaborative productivity to be highly related dimensions. The clustering also separated excellence and innovation as moderately correlated, indicating that supervisors see excellence and the capacity to innovate as complementary but somewhat different traits. The Job Maturity program was relatively central but set apart from the other clusters, indicating that although related, it might be a more general or independent construct that supervisors assess with a somewhat different perspective than other competencies.

In general, the dendrogram and heatmap analyses supported that competencies are not independent but instead constitute cohesive patterns of evaluation, which is consistent with the theoretical predictions of professional competence as a multi-dimensional yet interrelated construct.

Together, these models highlight the importance of competency correlation measurement for crafting more integrated, responsive OJT programs. Appreciation of competencies' interdependence enables curriculum strategies that establish core attributes with broad transfer impacts while offering competency-specific interventions for competencies such as Innovation, which develop independently. Instead of addressing competencies as separate objectives, OJT programs must support comprehensive systems-based development reflective of the complicated demands of contemporary professional settings.

CONCLUSION

Supervisor ratings analysis of Business Administration OJT students shows overall strong performance in all programs, with most ratings in the High to Very High categories. Chi-square tests showed significant relationships between the program and seven competencies (Professionalism, Job Maturity, Communication Skills, Productivity, Honesty, Integrity, Innovation, and Teamwork), with substantial variations in performance across concentrations. Bayesian ordinal correlation analysis established a high competency correlation (e.g., between Leadership and Excellence (0.76), Teamwork and Honesty & Integrity (0.75), and Professionalism and Honesty & Integrity (0.73). Competencies were grouped into character-oriented attributes, performance skills, development foundations, and innovation as specific skills.

This study recommends program-specific curricular modifications to address competency deficiencies. Professionalism and ethics should be bolstered throughout programs by using character competencies' intrinsic bundling. Special innovation courses, specifically for Financial Management students, should be implemented to address existing loopholes. Cross-program learning programs must be developed to port strengths like HR Management students' teamwork ability. Lastly, competency assessment measures must be developed to distinguish highly similar constructs such as Leadership and Excellence more precisely. Regular reassessment is needed to assess the efficacy of these interventions and to inform future curriculum development.

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