Prospectus

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Assignment

**Assignment #2 – Developmental Readings**

1. Create Developmental Readings from seminal sources and scholarly peer-reviewed

journal articles. Review instructions for Assignment #3, the course essential elements, and course readings to identify selections of books and journals to create entries.

1. Refer to the "Student Guide to Developmental Readings" in the General Helps folder for updated information on sample comments, the grading rubric, and key definitions related to developmental readings.

**Source One:** Poulson, M., Neufeld, M. Y., Dechert, T., Allee, L., & Kenzik, K. M. (2021). Historic redlining, structural racism, and firearm violence: A structural equation modeling approach. *The Lancet Regional Health - Americas*, *3*, 100052. <https://doi.org/10.1016/j.lana.2021.100052>

**Comment 1:**

**Quote/Paraphrase:** “Structural Equation Modeling (SEM) was the basis for the overall analysis. SEM is a multivariable technique that incorporates multiple regression equations to study the association of different variables in a causal pathway. For the purpose of this study, we were interested in assessing the mediating effects of neighborhood (census block) socioeconomic, and demographic variables in the pathway between historical redlining and the incidence of firearm violence today. This technique allows one to calculate the direct association between two variables and the indirect association between an independent mediator. Taken together, these direct and indirect effects can be combined to assess the total effect, which represents all pathways between the exposure and outcome of interest.” (Poulson et al., 2021, p. 3)

**Essential Element:** Dissertation data collection and analysis

**Additive/Variant Analysis:** The concept of utilizing SEM with geographical data, such as census blocks, is additive to my understanding of structural equation modeling.

**Contextualization:** In this article, the researchers provide a good summary of structural equation modeling and why they used it for their intended research. I have been thinking about being able to provide a good summary of using SEM in my dissertation project, examining the relationship between land use/land cover and illness, where I have not seen this kind of research being done, so being able to effectively communicate why structural equation modeling is the appropriate statistical procedure for my research will be important. I do believe that it is the right tool for analysis. I will be working with a vast number of variables, but I would not want to work with any fewer or cut my project down. I think this research is important for our healthcare system. One thing I do wonder about is whether I will need to stratify my analysis by regions, because I do foresee that the same land use may have different impacts on illness and health based on regional differences.

**Comment 2:**

**Quote/Paraphrase:** “We used generalized structural equation modeling, a variant of structural equation modeling, which provides flexibility in the modeling distributions and count data. This was used to identify multiple socioeconomic variables in the causal pathway between historic redlining and current firearm violence. Given the large number of census blocks with zero shootings (94%), we were unable to use a linear regression model. We assessed model fit comparing Poisson, negative binomial, and zero inflated Poisson with negative binomial shown to consistently have a lower Akaike Information Criterion (AIC) score (2423 for negative binomial, 2443 for Poisson, 2460 for zero inflated Poisson, p<0.001). Negative binomial models with robust error variance were then used to assess the incident rate ratio (IRR) in the direct and indirect pathways. The relationship between HOLC designation and the mediating variables created from the principal component analysis was evaluated in a Gaussian distribution. Our model was built using gsem in Stata 16, allowing for collinearity among covariates.” (Poulson et al., 2021, p.4)

**Essential Element:** Dissertation data collection and analysis

**Additive/Variant Analysis:** The concept of generalized structural equation modeling is additive to my understanding of structural equation modeling.

**Contextualization:** This article was interesting, not only the content, but also how it used SEM. This has provided me with insight into how flexible SEM is. They used generalized structural equation modeling, a modification of OLS-SEM, which allows for variables with count data and non-normal distributions, such as in this case, they used the Poisson distribution. This research also used census block geographic data in its SEM, which has helped me learn how researchers are incorporating geographic data into their structural equation models.

**Source Two:** Shirkey, G., John, R., Chen, J., Kolluru, V., Goljani Amirkhiz, R., Marquart-Pyatt, S. T., Cooper, L. T., & Collins, M. (2023). Land cover change and socioecological influences on terrestrial carbon production in an agroecosystem. *Landscape Ecology*, *38*(12), 3845–3867. <https://doi.org/10.1007/s10980-023-01647-5>

**Comment 3:**

**Quote/Paraphrase:** “We employed a PLS-SEM to construct the relationships between social, economic and ecological variables in our SES dataset concerning annual landscape production of NPP (i.e., the dependent variable) (Fig. 2). Compared to classic regression based approaches that assume simple model structure along with observable and perfectly measured variables (Haenlein and Kaplan 2004), SEM is a second generation technique that allows for the simultaneous modeling of relationships among dependent and independent constructs (Gefen et al. 2000). In SEM, one can distinguish between exogenous and endogenous latent variables, which are variables not explained by the proposed model (i.e., acting as independent variables) and those explained by the relationships in the model, respectively (Diamantopoulos 1994). For this study, we chose a PLS-SEM, which is suitable as an exploratory technique because it has fewer assumptions than the covariance-based SEM (CB-SEM) and operates on smaller sample sizes (Bollen 1989; Rigdon 2012; Rigdon et al. 2020).” (Shirkey et al., 2023, p. 3852)

**Essential Element:** Dissertation data collection and analysis

**Additive/Variant Analysis:** The concept of PLS-SEM is additive to my understanding of SEM.

**Contextualization: In** This article the researchers used PLS-SEM (partial least squares structural equation modeling. PLS-SEM differs a bit from OLS-SEM in several ways, and one may be more appropriate for a given analysis. PLS-SEM is a bit more flexible and could handle more complex modeling. In this article the researchers chose to use PLS-SEM because “…suitable as an exploratory technique because it has fewer assumptions than the covariance-based SEM (CB-SEM) and operates on smaller sample sizes”. I am unsure which I will need to use for my project examining the relationship between land use/land cover and illness. I imagine my data will meet the normality assumption for OLS-SEM, and for sure, it meets it for the sample size. I will need to look into this a bit more to decide.

**Comment 4:**

**Quote/Paraphrase:** “These findings also indicate that SES models may benefit from including multiple measures of LCLUC to explore how conventional land cover change indicators interact with socioeconomic measures of land management and land use, particularly across LCLUC rates of intensity. Our study also demonstrates that LCLUC can manifest within multiple SES processes (i.e., PLS-SEM constructs), each with unique relationships to NPP. We pose that land cover indicators may behave differently in PLS-SEMs in rapidly urbanizing or landscapes with notable land cover change, given the relative persistence in LCLUC in our study area.” (Shirkey et al., 2023, p. 3860)

**Essential Element:** Dissertation literature review

**Additive/Variant Analysis:** The use of land use/land coverage in SEM research is additive to my understanding of statistical analysis of geographical features such as land use/land cover.

**Contextualization:** This article examined the relationship between Land cover and land use change (LCLUC) and carbon production through socioecological latent variables. The journal articles that I have been finding look at land use/land cover change, there are a few that looked at LULC in a small geographic area and only a single illness/disease. This article was insightful, even though it was looking at land cover change it did a SEM and used sociological latent variables, as I will use socio-health latent variables.

**Source Three:** Memon, M. A., T., R., Cheah, J.-H., Ting, H., Chuah, F., & Cham, T. H. (2021). PLS-SEM STATISTICAL PROGRAMS: A REVIEW. *Journal of Applied Structural Equation Modeling*, *5*(1), i–xiv. <https://doi.org/10.47263/JASEM.5(1)06>

**Comment 5:**

**Quote/Paraphrase:** “In SmartPLS, users can graphically build a PLS path model and estimate it with their data using basic PLS-SEM (Lohmöller, 1989; Wold, 1982), weighted PLS-SEM (Becker & Ismail, 2016; Cheah et al., 2020a), consistent PLS-SEM (Dijkstra, 2014; Dijkstra & Henseler, 2015a; 2015b), and sum score regression algorithms (Hair et al., 2022; Marcoulides et al., 2012). The software provides additional algorithms that are useful for understanding and modelling composite-based models, such as advanced bootstrapping (Aguirre-Urreta & Rönkkö, 2018; Hair et al., 2022), confirmatory tetrad analysis (Gudergan et al., 2008), importance-performance map analysis (Ringle & Sarstedt, 2016), predictive power assessment using PLSpredict (Shmueli et al., 2016; Shmueli et al., 2019), predictive model comparison based on information criteria such as BIC (Chin et al., 2020; Liengaard et al., 2021; Sharma et al., 2019a, 2019b), multi-group analysis based on bootstrapping and permutation (Cheah et al., 2020; Chin & Dibbern, 2010; Hair et al., 2018b), latent class segmentation using finite mixture PLS (Hahn et al., 2002; Sarstedt et al., 2011), and prediction-oriented segmentation (Becker et al., 2013).” (Memon et al., 2021, p. 5)

**Essential Element:** Dissertation data collection and analysis

**Additive/Variant Analysis:** The use of different statistical software to conduct SEM research is additive to my understanding of SEM.

**Contextualization:** I have noticed there are several different SEM statistical programs that different researchers use, such as; SmartPLS, AMOS, R and a few others. This researcher uses SmartPLS, which was recommended by Dr. Reichard and was obtained. I have heard of good reviews of SmartPLS. I have access to SPSS/AMOS, but I want to work in R. Since I have SmartPLS I will start working in it for SEM and also begin learning R and will probably do SEM in R as well for a comparison on the statistical software. SmartPLS by reviews and from this article has many great features and has good visualization capabilities. I am looking forward to running SEM in SmartPLS.

**Source Four:** Wang, C., Ma, L., Zhang, Y., Chen, N., & Wang, W. (2022). Spatiotemporal dynamics of wetlands and their driving factors based on PLS-SEM: A case study in Wuhan. *Science of The Total Environment*, *806*, 151310. <https://doi.org/10.1016/j.scitotenv.2021.151310>

**Comment 6:**

**Quote/Paraphrase:** “GWR is usually used to quantify spatial heterogeneity by establishing relationships between dependent and independent variables with spatial attributes. A prerequisite for applying the GWR model to analyze is the existence of spatial correlation between the spatial distribution of wetlands and the driving factors. In this study, each independent variable in GWR either promoted or resisted wetland changes. GWR can be given by

A number and mathematical symbols

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where yi is a dependent variable representing the wetland proportion in the ith cell, xij is the jth independent variable (driving factor) at position (ui, vi), and βj(ui, vi) is the intercept at location (ui, vi), which is usually used for local estimation by the weighted least square method. k.” (Wang et al., 2022, p.6)

**Essential Element:** Dissertation data collection and analysis

**Additive/Variant Analysis:** The use of Geographically Weighted Regression (GWR) in SEM, dealing with geographical research, is additive to my understanding of SEM.

**Contextualization:** Geographically Weighted Regression (GWR) is a statistical regression used in geographic analysis, which basically performs separate ordinary least squares regression on each spatial unit (different counties, ZTCA, etc.). Thus, the spatial aspects of a given geographic area could have an additional impact on the regression model. This could have a particularly significant impact on SEM, as these researchers used and incorporated GWR in their SEM. This may be an important aspect of my project on the relationship between land use/land cover and illness, given that land use is indeed a spatial feature. I know GIS software is able to run GWR, and this article they used R to incorporate GWR into their SEM.

**Source Five:** Eroglu, H., & Metin, Z. G. (2024). Correlation between symptom status, health perception, and spiritual well‐being in heart failure patients: A structural equation modeling approach. *Journal of Nursing Scholarship*, *56*(4), 490–506. <https://doi.org/10.1111/jnu.12961>

**Comment 7:**

**Quote/Paraphrase:** “Structural Equation Modeling (SEM) is a multivariate statistical analysis that authorizes a hypothetical model approach for testing theoretically linked pathways between constructs within a definite phenomenon (Byrne, 2001). Based on Wilson and Cleary's HRQOL conceptual model, we proposed a hypothesized model. This analysis was conducted using Analysis of Moment Structures (AMOS) software, version 29. The standardized regression coefficient (β) shows the effect of an independent variable on a dependent variable using the SEM model. The independent variables were age, marital status, educational status, employment status, income level, LVEF, comorbidities, NYHA class, symptom status, and health perception, whereas the dependent variable was SWB. Additionally, the non-standardized indirect, direct, and total effects of all data were calculated. The critical ratio (CR) was computed by dividing the predicted value by its standard error. When CR > 1.96 for a regression weight, the relationship is considered statistically significant (Hox & Bechger, 1998). The level of statistical significance was set at p< 0.05.” (Eroglu & Metin, 2024, p. 495)

**Essential Element:** Dissertation data collection and analysis

**Additive/Variant Analysis:** The example this article provides in reporting of SEM is additive to my understanding of SEM in research.

**Contextualization:** This quote provides an example of some of the items that are within the data analysis section of a journal article using SEM. The author starts out with a brief description of SEM, and how the researcher’s theoretical model fits within the SEM framework. Then the author reports what statistical software to run the SEM, in this case, the researcher used AMOS, as an SPSS add-on package. The variables are mentioned and how they fit within the SEM. Then the researcher reports some key SEM statistical output and how the SEM performed.

**Source Six:** Park, S., Lee, H. J., Jeon, B.-J., Yoo, E.-Y., Kim, J.-B., & Park, J.-H. (2021). Effects of occupational balance on subjective health, quality of life, and health-related variables in community-dwelling older adults: A structural equation modeling approach. *PLOS ONE*, *16*(2), e0246887. <https://doi.org/10.1371/journal.pone.0246887>

**Comment 8:**

**Quote/Paraphrase:** “The fit index of the final model was NC (x2/df) = 1.708 (x2 = 877.917, df = 514, p < .001). Overall indices were acceptable (RMSEA = .058, TLI = .923, CFI = .929, SRMR = .067). Except the direct path between occupational balance and stress (p = .060), all the direct paths in the modified model were significant at the 95% confidence interval. Although the path between occupational balance and stress was not statistically significant at the 95% confidence interval, we determined to retain the path in the final model because the association between occupational balance and stress was supported by previous studies, and we discovered that the overall fit indices decreased when the path was eliminated (NC = 1.712, p < .001, RMSEA = .059, TLI = .922, CFI = .929, SRMR = .071).” (Park et al., 2021, p. 8)

**Essential Element:** Dissertation data collection and analysis

**Additive/Variant Analysis:** This article displays the narrative based reporting of the SEM output, which is additive to my understanding of how to report SEM in journal articles.

**Contextualization:** In journal articles, SEM summary output is written in a narrative form, and is also shown in table format and visual model displays. The above quote is a good example of how researchers incorporate reporting the SEM fit and summary statistics within the body of the text. It not only provides the reader with an understanding of the performance of the SEM, but it also provides some context for the findings.

**Source Seven:** Klainin-Yobas, P., Vongsirimas, N., Ramirez, D. Q., Sarmiento, J., & Fernandez, Z. (2021). Evaluating the relationships among stress, resilience and psychological well-being among young adults: A structural equation modelling approach. *BMC Nursing*, *20*(1), 119. <https://doi.org/10.1186/s12912-021-00645-9>

**Comment 9:**

**Quote/Paraphrase:** “We determined model fits through the following parameters: a) confirmatory fit index (CFI), Incremental Fit Index (IFT), Tucker-Luwis Index (TLI) > 0.90 as acceptable fit and > 0.95 as well-fit, and b) root mean square of error of approximation (RMSEA) < 0.05 as well-fit and < 0.08 as reasonable fit [26]. We used a difference in chi-square statistics (Δχ2) and difference in comparative fit index (ΔCFI) to determine if statistical parameters were equivalent across the Samples 1 and 2 [26]. Specifically, a significant Δχ2 at the probability of less than 0.05 would indicate that the equality constraint model was significantly different from the baseline model. This served as evidence to determine that the hypothesized models were completely non-equivalent across samples (i.e., statistical parameters of the Samples 1 and 2 were not equivalent) [26]. Additionally, ΔCFI that less than the value of 0.01 would indicate that statistical parameters were not equivalent across samples [26].” (Klainin-Yobas et al., 2021, p. 5)

**Essential Element:** Dissertation data collection and analysis

**Additive/Variant Analysis:** The narrative-based summary of the SEM performance in this article is additive to my understanding of SEM.

**Contextualization:** This article uses certain parameters to examine the fit of the SEM model, such as confirmatory fit index (CFI), Incremental Fit Index (IFT), Tucker-Luwis Index (TLI), root mean square of error of approximation (RMSEA) and the difference in chi-square statistics. Confirmatory fit index measures the relative improvement in fit going from the baseline model. Incremental Fit Index measures the fit of the model compared to a null model.The Tucker-Luwis Index measures the reduction in non-fit per degree of freedom. The root mean square of error of approximation measures the difference due to the approximation per degree of freedom. The difference in chi-square statistics measures the difference in chi-squared within nested models and is related to the difference in confirmatory fit index.

**Source Eight:** Huang, J., Wang, L., Liu, S., Zhang, T., Liu, C., & Zhang, Y. (2021). The Path Analysis of Family Doctor’s Gatekeeper Role in Shanghai, China: A Structural Equation Modeling (SEM) Approach. *INQUIRY: The Journal of Health Care Organization, Provision, and Financing*, *58*, 00469580211009667. <https://doi.org/10.1177/00469580211009667>

**Comment 10:**

**Quote/Paraphrase:** “Composite reliability (CR), and average variance extracted (AVE) were used to assess convergent validity.22 The CR values was around 0.60 as we used self-created items to construct latent variable, and values of AVE were greater than 0.40, which were not that reliable and convergent compared with early developed and repeatedly practice scales but also acceptable.23 The discriminant validity showed that correlations among constructs were all below the square root of AVE for all construct suggesting a well discriminant validity. Thus, convergent validity and discriminant validity were supported (Tables 2 and 3).” (Huang et al., 2021, p. 3)

**Essential Element:** Dissertation data collection and analysis

**Additive/Variant Analysis:** This quote about testing the SEM validity is additive to my understanding of SEM.

**Contextualization:** The indicators in this quote are used to measure the validity of the SEM. Composite reliability is used to measure the internal consistency of measured and latent variables. If the Composite reliability is > 0.7, then the measured variables have shared variance among them, thus indicating internal validity.The average variance extracted measures the variance of the measured variable explained by the latent variable. If the AVE is > .5 then it has convergent validity. Convergent validity has to do the correlation among variables. This article is a good example of reporting the SEM validity.

**Source Nine:** Clausen, J., Barrantes, N., Caballero, E., & Guillén, H. (2024). Exploring the Association between Multidimensional Poverty and Depression Using Structural Equation Models. *Applied Research in Quality of Life*, *19*(2), 727–747. <https://doi.org/10.1007/s11482-023-10262-0>

**Comment 11:**

**Quote/Paraphrase:** “Figure 2 presents the association between multidimensional poverty and major depression. Multidimensional poverty had a positive and significant association with major depressive disorder. Specifically, we find that a unit of standard deviation increase in multidimensional poverty is related to 0.043 units of standard deviation increase in major depression (β = 0.043, p < 0.001). This result remained valid even after controlling for variables like gender, ethnicity, area of residence (urban/rural), and whether the person lived in the capital city or elsewhere. Overall, these results supported our hypothesis and highlighted the similarities with the findings of other studies exploring a similar relationship in other contexts using SEM (Li et al., 2018, 2019, 2020). (Clausen et al., 2024, p. 378)

**A diagram of a model

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**Essential Element:** Dissertation data collection and analysis

**Additive/Variant Analysis:** The concept of describing the SEM in narrative form and in a SEM visual model, as well as in a table format, is additive to my understanding of SEM used in research.

**Contextualization:** The SEM journal articles state modael summaries in narrative form as well as include model visuals and tables describing the SEM they used. I wanted to take a look at the visual displays a bit so I included this article’s model summary. The article informs what the model visual is displaying, “Figure 2 presents the association between multidimensional poverty and major depression. Multidimensional poverty had a positive and significant association with major depressive disorder.” The visual shows that multidimensional poverty and major depression are latent variables and the measured variables such as years of schooling and housing inform multidimensional poverty and the measured variables such as depressed mood and fatigue inform the latent variable major depression. And “multidimensional poverty is related to 0.043 units of standard deviation increase in major depression”. Table 4 shows the model summary based on the selected controlling variables and lists the unstandardized coefficients, standardized coefficients, standard error, critical ratio, and the p-value.

**Source Ten:** Sheskin D. (2011). *Handbook of parametric and nonparametric statistical procedures 5 ed*. CRC Press.

**Comment 12:**

**Quote/Paraphrase:** “Structural equation modeling is a modeling procedure employed by researchers in multiple scientific disciplines. SEM has the following two goals: a) To understand patterns of correlations among a set of variables; and b) To explain as much of the variance as possible with a hypothesized model specified by a researcher. More specifically, structural equation modeling (which employs many of the principle underlying path analysis) investigates the relationship between latent variables (also referred to as unmeasured/unobserved variables, factors, or constructs) or the relationship between latent variables and both latent and measured variables (also referred to as observes/indicators/manifest variables). Its popularity is predicated on researchers’ desire to identify and measure the nature of the complex relationships between multiple variables, and within that process obtain insight into issues relating to cause and effect.” (Sheskin, 2011, p. 1687)

**Essential Element:** Dissertation data collection and analysis

**Additive/Variant Analysis:** This description of structural equation modeling is additive to my current understanding of SEM.

**Contextualization:** The above quote is a good description of what structural equation modeling is and the purpose of using SEM. I do think that SEM is the appropriate statistical procedure to use for my project examining the relationship between land use/land cover and illness. I don’t know if one could have an unknown latent variable that holds a certain explanation of the relationship, that is not included in the researcher’s specified latent variables, it would be handy to have a value of other unknown factors involved in explaining the overall model. The Health Lifestyle Theory developed by the medical sociologist, William Cockerham is the theoretical perspective I will be using. The Health Lifestyle Theory has eight conceptual variables that would fit nicely into the latent variables classification: 1) Class Circumstances (age, gender, race/ethnicity, living conditions; 2) Socialized Experience; 3) Life Choices (agency); 4) Life Chances (structure); 5) Disposition to Act (habitus); 6) Practices (action); 7) Health attributes (diet, exercise, smoking, etc.) and all these yield to 8) Health Lifestyles (reproduction). Given my measured variables of land use and illness, I will need to develop my theoretical model to include latent variables.

**Source Elven:** Whittaker, T and Shumacker, R. (2022). *A beginner’s guide to structural equation modeling, 5th ed*. Routledge.

**Comment 13:**

**Quote/Paraphrase:** “…list of ten commandments for good structural equation modeling analysis and reporting: (1) avoid conclusions that a model is the only one to fit the data; (2) cross-validate any modified model with split-sample or new data; (3) test multiple competing models; (4) evaluate measurement models first, then structural models; (5) evaluate models by fit, theory, and practical concerns; (6) report multiple model fit indices; (7) meet multivariate normality assumptions ; (8) purse parsimonious models; (9) consider variables scales of measurement and distributions; and (10) do not use small samples.” (Whittaker & Shumacker, 2022, p. 350)

**Essential Element:** Dissertation data collection and analysis

**Additive/Variant Analysis:** The ten recommendations above for conducting SEM analysis is additive to my understanding to structural equation modeling.

**Contextualization:** The list above of ten commandments for structural equation modeling provided a good summary of the steps that need to be taken to ensure SEM is being properly done. It provided further understanding of what things I need to consider in conducting SEM on my project of the relationship between land use/land cover and illness. I have not found exact research on what I am doing, so it is very helpful to have the guidance presented in this book. In addition, I have not done a SEM before, I have done multiple regression on several occasions, and had a statistics course where we covered path analysis. So I think I have the background to pick up SEM well, there is just a lot to SEM.

**Works Cited**

Clausen, J., Barrantes, N., Caballero, E., & Guillén, H. (2024). Exploring the Association between Multidimensional Poverty and Depression Using Structural Equation Models. *Applied Research in Quality of Life*, *19*(2), 727–747. <https://doi.org/10.1007/s11482-023-10262-0>

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