COMPETENCY GUIDE: RESEARCH METHODS (PA515)

Applying methodological and statistical skills to model building and problem solving

Students must exhibit an understanding of basic methodological standards and processes.
1. Given a scenario describe and justify a strategy to develop a model, select a research design and sample, organize a research team.
2. Given a research question and a description of a data base develop a strategy for conducting the data analysis.
3. Know what constitutes ethical treatment of human research subjects, and how ethical issues can apply to social scientific research.

Applying specific methodological concepts to reported research findings

Given a research report that is already completed, a student must be able to…
1. Identify the central hypothesis, its components and direction.
2. Evaluate the hypothesis and model.
3. Identify conceptual and operational definitions.
4. Evaluate the reliability and operational validity of measures.
5. Identify and distinguish between the population, target population, sampling frame, parameters, statistics, unit of analysis.
6. Evaluate sampling frame and sampling design (use of probability and non-probability samples)
7. Evaluate and distinguish between sampling error and non-sampling error
8. Identify and explain potential threats to internal validity and external validity
9. Evaluate strengths and limitations of research designs (cross-sectional, time series, comparison groups, experimental)
10. Interpret findings from a cross-sectional, time-series (graphical data), experimental or comparison group (quasi-experimental) design

Applying specific methodological concepts to the development of research proposals

Given a proposed research problem, a student must be able to…
1. Write a hypothesis, identify its components and direction.
2. Identify unit of analysis, population, target population.
3. Address any possible control variables that may be relevant, and explain why they are relevant with respect to the internal validity of the study.
4. Develop conceptual and operational definitions for all concepts and establish means for gauging the reliability and operational validity of all measures.
5. If project lends itself to survey data collection, choose sampling decisions, including the selection of sample design, sampling frame, and sample size. Justify choices with respect to the external validity of the study.
6. If project lends itself to experimental or quasi-experimental data collection, choose and justify design parameters (comparison groups, randomization, environment), addressing any major concerns with respect to internal and external validity.
7. Address standards of significance testing (Alpha levels) and tradeoffs between Type I and Type II errors.

**Applying specific statistical concepts**

Students must show competence with the interpretation and applicability of basic statistical concepts.

1. Given a problem statement and a small data set present and interpret the data in a frequency distribution contingency table or means table. Compute measures of central tendency, determine which measure of central tendency is appropriate to report.
2. Understand the meaning and use of univariate descriptive statistics: frequency distributions, measures of central tendency or dispersion. Be able to assess and explain the accuracy and applicability of interpretations of univariate statistics provided in examples.
3. Understand the meaning and use of bivariate descriptive statistics: primarily contingency tables (including 3-way or "control" tables), means tables and measures of association. Create and interpret contingency tables and means tables.
4. Understand the meaning and use of univariate inferential statistics, in particular, confidence intervals and sampling error. Be able to interpret a 95 percent confidence interval for proportional data in order to estimate a population parameter.
5. Understand the meaning and use of bivariate inferential statistics, in particular $\chi^2$ and t-tests. Interpret contingency tables, means tables and tests of statistical significance (calculations are not required). Understand the difference between statistical significance and "practical" significance. Understand the practical implications of Type I error and Type II error as they apply to the selection of Alpha levels.
6. Be able to identify the "Null" and "Alternative" hypotheses and explain the role of significance tests within the process of hypothesis testing (disconfirming the null hypothesis).
7. Interpret linear regression findings presented as an equation or in a table, explain what information r, b (unstandardized regression coefficient) and Beta (standardized regression coefficient) provide; calculate the estimated value of the dependent variable.
8. Be familiar with common problems in correctly interpreting linear regression findings, i.e., use of a categorical dependent variable, non-linear relations between
independent and dependent variable, predicting outcomes beyond the values of
independent variable included in data set.

Note: in answering questions on research methods you should show an awareness of
sound research practices and the constraints that operate in conducting applied
research