Missouri State Human Subjects Protection Application

**Title:** Using Item Response Theory to Explore Scale Psychometrics

**Description:**

Item response theory (IRT) is a type of statistical analysis that allows a researcher to examine the underlying pattern of data in a set of questions. IRT is often called latent trait theory because it examines questions or items to determine if there is a primary concept that causes the way that someone answers a questionnaire. For example, the Depression, Anxiety, and Stress Scale is thought to measure different psychological constructs in a way that a participant’s depression or stress levels will be shown through subscale scores. Traditional approaches to scale development and assessment usually are analyzed with factor analysis, through both exploratory and confirmatory approaches. These statistical tools allow a researcher to understand 1) how many latent variables their scales are measuring, 2) which questions appropriately measure those latent variables (and alternatively, which questions are not useful), and 3) model fit of the questionnaire (i.e. underlying variables match theory and explain the data collected) (Buchanan, Valentine, & Schulenberg, *2013*). Further, complex designs, such as multi-trait multi-method and multigroup confirmatory factory analysis can be used to determine exactly how items are answered across groups indicating group differences in question answering (Trent et al., 2013). However, these analyses are limited in their ability to detect particular participant profiles in the data, which can be determined by using item response theory.

Customarily, item answers are averaged or totaled to create an overall score for a questionnaire. If a particular scale has four questions, two participants may arrive at the same overall score by marking a) low, low, high, high or b) high, high, low, low on the items. By using IRT, we can answer three different types of research questions about participant answers on these scales. First, we can do tailored testing, which will show how participants arrived at their overall scores, thus answering the low-high discrimination problem. Second, we can measure item bias across subpopulations that take our scales. These questionnaires are conventionally designed and tested on college students, but this analysis would allow us to examine how a college student population differs from a clinical or adult population. Each item can be equated for discrimination or difficulty, which can be used to explore the interesting interactions found within the meaning in life research field (i.e. men show a strange interaction with alcohol use and purpose in life scores, while females do not; Schnetzer, Schulenberg, & Buchanan, 2012). Lastly, IRT can be used to equate scales (or conversely, show divergent validity). This ability is especially useful to create short form versions of scales to decrease the amount of time necessary to screen or test participants. Short forms have become especially popular for evaluating clinical and adult populations who often are short on time for research experiments.

Scale development work in this particular research area has been published using exploratory and confirmatory factor analysis. The Meaning in Life Questionnaire (Steger, Frazier, Oishi, & Kaler, 2006), Seeking of Noetic Goals questionnaire (Schulenberg, Baczwaski, & Buchanan, 2013), and Purpose in Life Test (Morgan & Farsides, 2009) have been explored for their reliability and validity by examining factor structure. Meaningfulness has been applied extensively to other psychological issues, such as positive affect (King, Hicks, Krull, & Del Gaiso, 2006), religiosity (Steger & Frazier, 2005), drug problems (Newcomb, Vargas-Carmona, & Galaif, 1999) and alcohol use (Palfai, Ralston, & Wright, 2011). However, a literature search of the application of IRT to meaning in life reveals a dearth in publications. Oishi (2007) has published a chapter on how research in positive psychology should apply both structural equation modeling and IRT to their measurement scales. This lack of publications indicates an excellent avenue of potential unexplored research on these scales and their applications.

***Specific Goals*.** IRT theory will be applied to specific questionnaires to answer the following questions: 1) What is the discriminability of each item for participant scores? 2) Are items consistently answered across specific subpopulations (gender, ethnicity, age)?, 3) Are these scales equivalent measurements of meaning in life?, and 4) Are equivalent short form measurements possible? 5) Is the delivery method of the scale an important component to scores (Weigold, 2013)?

**Research Protocol:**

***Participants****.* Participants will be recruited through the Psychology Department’s undergraduate subject pool. Students enrolled in PSY 121 (Introduction to Psychology) are required to participate in research activities for course credit. Our department uses the SONA online participant management system to display research studies to participants and track the number of studies they have completed. Participants are required to complete six 30-minute credit opportunities, and this study will be approximately two credits because of the length of time required to complete all parts of the study. This study will also collaborate with the University of Mississippi to collect adequate sample sizes. Gao and Chen (2005) have suggested that over 1,000 participants are necessary to adequately assess IRT models. Therefore, both universities will collect data on their participant pools with IRB approval. Here at MSU, my research lab will assist in data collection of approximately 500 to 750 participants.

***Materials****.* Scales associated with meaning and purpose will be used for this study. The principal investigator has worked extensively on the psychometrics of many of these scales and am interested in understanding their inner workings further. Participants will be given a wide range of related scales to examine both if individual scales show response patterns, as well as patterns across relevant scales. All of these scales employ a Likert-type response format, except for the Life Purpose Questionnaire that uses a yes/no dichotomous format. Participants will also be asked to provide relevant demographics such as age, gender, and ethnicity as research has shown that items on scales can perform differently depending on demographic subpopulation. Table 1 shows example scale items, and some example scales are attached.

Table 1. *Meaning in Life Scales*

|  |  |  |
| --- | --- | --- |
| Scale | Number of Items | Example Question |
| Purpose in Life Questionnaire – Short Form | 4 | In life I have… 1 (no goals or aims at all) to 7 (very clear goals and aims). |
| Life Purpose Questionnaire | 20 | I have made only a little progress toward reaching my life goals. |
| Meaning in Life Questionnaire | 10 | Presence: I understand my life’s meaning.  Search: I am searching for meaning in my life. |
| Seeking of Noetic Goals test | 20 | I feel that some element which I can’t quite define is missing from my life. |
| Satisfaction with Life Scale | 5 | In most ways my life is close to ideal. |
| Boredom Proneness Scale | 28 | Time always seems to be passing slowly. |

***Procedures****.* Participants will sign up for the study on SONA (or their respective participant management system). They will be given a consent form that explains the nature of the study and who to contact with questions about the research project. If they consent to participate, they will be given a packet of all survey questions to complete, and survey order will be randomized across participants. Participants will be given credit at the end of the experiment based on time spent participating (i.e. 30-minutes is one credit, >30 minutes is two credits). Survey completion traditionally takes approximately 40 minutes, but participants will be reminded that participation is voluntary and can leave at any time. No risks are expected in this experiment. One group of participants will be given the study online, while another group will be given the study in the lab to examine the relationship between delivery and item profiles.

***Consent***. See attached. The consent form will not be connected to their survey packets to maintain participant confidentiality, and online consent will be given for computer participants (which are separated from surveys with participant data).

***Security of Data****.* Data will be kept secure locked in a filing cabinet in the research lab or on research computers that require a password for access. Data are confidential and will be maintained on the research computers until after publication.

***Data dissemination.***This project is likely to lead to several publications in peer-reviewed journals, as each scale has the potential to be an interesting research article. Example journals include *Journal of Clinical Psychology, Journal of Personality Assessment, Journal of Happiness Studies, Assessment* and *Multivariate Behavioral Research.* Further, this research can be presented at the *American Psychological Association*’s annual meeting.

***Benefits*.** Understanding meaning in life scales, as well as their profiles, will help in many areas. First, short forms are beneficial for time saving measures and especially useful when gathering data in the field (i.e. assessing meaning after a hurricane by collecting data at a FEMA station). Further, the underlying profiles may give more insight into the relationships between meaning, depression, drinking, anxiety, and other psychological phenomena. Better understanding of the scale’s properties will help promote the scale as a possible screening measure or its use in future research. Students will receive course credit for their participation. This research will be sent for publication for other researchers to use.

***Risks*.** While some participants may have a reaction to test questions, general risk is low. Previous research using these questionnaires has resulted in no reported problems. Concerned participants will be referred to the appropriate campus resource, and all participants are given a short blurb on the Counseling Center to minimize risk.

**Consent to Participate in an Experimental Study  
Title:** Using Item Response Theory to Explore Scale Psychometrics

|  |  |
| --- | --- |
| **Investigator**  Erin Buchanan, Ph.D. Department of Psychology 214D Hill Hall  Missouri State University  417-836-5592 |  |

**Description:**  
This study will investigate the relationship between different meaning in life scales, which will ask you about your perceived meaning in life, thoughts about goals, and general purpose of your life actions. The purpose of the study is to understand the relationship between these feelings and how they might be improved by offering better ways to understand those measures. If you feel troubled answering the questions, please feel free to opt out of the survey. Your information will be kept confidential, so please do not write your name on any other survey sheets. If you are having problems or are worried about your results, please talk to the experimenter, who will give you the information for counseling services on campus.

**Risks and Benefits:**  
Participants may feel uncomfortable while taking this questionnaire. You may leave the experiment at any time and are not required to fill out all the questions.

**Confidentiality:**  
We will not put your name on any of your tests. Only Dr. Buchanan and her assistant will have access to the data collected for this study. All data associated with this study will remain confidential.

**Right to Withdraw:**  
You do not have to take part in this study. If you start the study and decide that you do not want to finish, all you have to do is to tell Dr. Buchanan in person, by letter, or by tele­phone at the Department of Psychology, 214D Hill Hall, or 836-5592. Whether or not you choose to participate or to withdraw will not affect your standing with the Department of Psychology, or with the University, and it will not cause you to lose any benefits to which you are entitled. Experimental credit will be prorated based on the amount of time you spent in the study.

**IRB Approval:**  
This study has been reviewed by Missouri State University’s Institutional Review Board (IRB). The IRB has determined that this study fulfills the human research subject protections obligations required by state and federal law and University policies. If you have any questions, concerns, or reports regarding your rights as a participant of research, please contact the Office Research Compliance at 836-4132.

**Statement of Consent:**  
I have read the above information. I have been given a copy of this form. I have had an opportunity to ask questions, and I have received answers. I consent to participate in the study.

(signature lines for in person studies, online check boxes for online studies – if someone does not consent they are taken to a thank you screen).