

Psychometrics in Taiwan: The Past, Present, and Future

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Psychometrics is a field of psychology dedicated to the development of quantitative models to enhance our understanding of human behavior and mind. For the 60th anniversary of the publication of the *Chinese Journal of Psychology*, the articles published over the sixty years in the journal are reviewed to portray the development of psychometric research over this period and to relate psychometrics to various fields of psychology by analyzing the methods used in each study. This study also surveys the research interests of present psychometricians in Taiwan, and looks to the future of psychometric research and education. Through the review and prospects, we hope to rethink the role of psychometrics in psychology and in our society to enhance dialogue and to promote future collaboration between psychometricians and researchers in various other fields of psychology.

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To celebrate the 60th anniversary of the publication of the *Chinese Journal of Psychology* (CJP), the 859 articles published between 1958 and 2017 were reviewed. The distribution of articles across various fields of psychology was examined with special attention devoted to the psychometric research published over the six decades. The major analytical method employed in each publication was summarized to portray the connection between psychometrics and other fields of psychology. The research interests of psychometricians in Taiwan was also surveyed to supplement the developmental trajectory of psychometric research observed in the Journal, shed light on the current status of psychometrics in Taiwan, and suggest the possible future outlook for the field.

Psychometrics is a field of psychology devoted to the development of statistical models and methods to summarize, describe, and draw inferences from empirical data for understanding and interpreting human behavior and psychological processes (Jones & Thissen, 2007). Because Psychometrics emphasizes quantification and the

mathematical treatment of psychological phenomena, the term is sometimes used interchangeably with Quantitative Psychology. However, as Thurstone (1937) stated, “a psychological theory is not good simply because it is cleverly mathematical... In the long run we shall be judged in terms of the significance, the fruitfulness and the self-consistency of the psychological principles that we discover.”

Following Weng, Chang, and Yao (1996), we classified the main subfields in psychometrics into five categories to reveal the developmental trend of psychometric research in Taiwan over the years. The five categories are (1) *test theory* (classical test theory, item response theory, generalizability theory, and etc.), (2) *factor analysis and structural equation modeling*, (3) *scaling and classification* (unidimensional scaling, multidimensional scaling, clustering analysis), (4) *other statistical methods* (e.g., ANOVA, regression analysis, time series analysis, categorical data analysis, nonparametric statistics, hierarchical linear model,

linear and nonlinear multivariate methods), and (5) *other quantitative and mathematical models or methods* (e.g., choice and decision models, social network, mixture models, latent class models, mathematical psychology). These five categories are similar to the major research themes found in *Psychometrika's* 50th and 80th anniversary sections, published in 1986 and 2016, respectively, and also include the three major classes of psychometric models and methods identified in Jones and Thissen (2007). Each piece of psychometric research published in the *Chinese Journal of Psychology* over the 60 years of its existence was classified into one of these five categories after a thorough review of the 859 published articles in the journal.

Six Decades of Articles Published in the Chinese Journal of Psychology

Research Fields of Articles in CJP

The research field of each of the 859 articles was first identified. Experimental and cognitive psychological research constitutes more than one third of the published work (36.7%), followed by research on social and personality psychology (18.7%), clinical and counseling psychology (14.8%), and developmental and educational psychology (12.7%). The percentages of articles classified into these four areas generally remained stable across the six decades. Compared to other fields, work on industrial and organizational psychology (6.8%) and psychometrics (5.4%) started later in CJP but has increased substantially over recent years. *However, research on psychological testing has a long history in Taiwan. Work on physiological psychology (2.8%) and other areas of psychology (2.2%) comprise the smallest proportion of articles published in CJP.*

Psychometric Research in CJP

A total of 46 articles were classified as *psychometric work*, covering a wide range of topics. About 70% of these articles were published in the past two decades. Seventeen articles were categorized into the area of *test theory*, amounting to more than one third of the

psychometric articles. Nine articles were classified under the category of *factor analysis and structural equation modeling*, all of which were published in the past twenty years. The five articles in the area of *other quantitative and mathematical models or methods* mainly focus on mathematical psychology, and four of these were published in the last decade. The three articles in *scaling and classification* relate to psychological scaling. The ten articles in *other statistical methods* cover a variety of research topics, including estimation of means, ANOVA, and regression.

Psychometricians / Quantitative

Psychologists in Taiwan

Psychometric research, apart from psychological testing, started late in Taiwan and journals other than *CJP can be the outlets of choice for sharing psychometric work*. Therefore, a survey of psychometricians / quantitative psychologists was conducted to provide a clearer picture of the current status of psychometric research in Taiwan. In this study, psychometricians/quantitative psychologists were confined to those researchers whose PhD thesis focused on topics in the field of psychometrics. Seventy-one researchers were identified, made up of 37 males and 34 females. Compared to a similar survey conducted in Weng et al. (1996), the number of researchers devoted to this field has grown substantially, from 30 in 1996 to 71 in this study. Of the 71 quantitative psychologists, 23 (32.4%) received their PhD degrees earlier than 1995, and 48 (67.6%) after 1996. As in the 1996 survey, the majority of psychometricians are professors in universities (62, 87.4%). Because of the reforms in curriculum and educational systems over the past twenty years, an increasing number of psychometricians are employed in research centers for testing (8, 11.3%).

The research interests of the majority of the 71 psychometricians lie in the area of *test theory*, with about 36.6% (26) working on theoretical developments and another 36.6% (26) on related applications, which is similar to the findings in Weng et al. (1996). We also observed a growing number of psychometricians

with research interests in *factor analysis and structural equation modeling* as well as in *other quantitative and mathematical models or methods*, when compared to the 1996 survey. The 71 identified psychometricians are distributed over 40 departments in universities or research institutes. Of these 40 units, 27 university departments have only one faculty member majoring in quantitative psychology. Faculty members with a background in psychometrics are usually expected to take responsibility for teaching quantitative psychology to lay a solid foundation for quality psychology research. With the limited manpower in teaching psychometrics, we earnestly suggest that university departments increase faculty hiring in the area of psychometrics and consider candidates who have a minor in psychometrics.

This study also conducted a survey on the need for psychometricians in testing companies and organizations in Taiwan. The survey revealed that these institutions are still in need of more psychometricians but also have budget constraints on hiring. Ability in statistical analysis is considered the most critical qualification for future psychometricians. The future outlook and employment prospects for psychometricians seem bright and positive. However, this conclusion is based on a small-scale survey and should be interpreted with caution.

Analytical Methods Adopted in the *Chinese Journal of Psychology*

Faculty with a background in psychometrics or quantitative psychology are usually expected to take responsibility for teaching statistics, measurement, and related subjects. Linking psychometrics to other fields in psychology, this study also identified the main data analytical method of each article and classified the method into one of 23 categories. These categorizations of analytic methods followed and extended upon the survey of Aiken, West, and Millsap (2008) on doctoral training in statistics, measurement, and methodology in psychology, including various core and specialized statistical methods, measurement and scaling methods, and methods in mathematical psychology. Three categories (simulation

study, qualitative study, and review article) were added to serve the purpose of this study. To simplify the analysis and to avoid confusion, we considered only one major analytical method adopted to answer the main research question in each article. The results suggest that the *analysis of variance* (ANOVA) was used in nearly half of the reviewed articles (46.8%), followed by *categorical data analysis* (7.3%), *test construction* (5.9%), *multiple regression* (5.7%), and *factor analysis* (5.7%).

To see the trend over the past 60 years, the methods used in these 859 articles were cross-tabled with time in blocks of 10 years. ANOVA and *categorical data analysis* are the dominant methods across the six decades. Over the past twenty years, multiple regression analysis has gained in popularity, possibly due to researchers' increasing interest in mediation and moderation effects. The analytical methods used have become more diversified over the past two decades, with newer methods such as *structural equation modeling*, *hierarchical linear model*, and *latent class analysis* being utilized in empirical research.

Research in the various areas of psychology has differed in the analytical methods used. Except for articles in *psychometrics* and *industrial and organizational psychology*, ANOVA is the most commonly used method in analysis. More than 60% of the articles in *experimental and cognitive psychology* and *physiological psychology* used ANOVA. Because of small sample sizes and non-normality in data, nonparametric methods are used more frequently in *physiological psychology* than in other areas. Similar data analytical methods are used for articles in the areas of *social and personality psychology*, *clinical and counseling psychology*, and *developmental and educational psychology*, including *categorical data analysis*, *multiple regression*, *factor analysis*, and *structural equation modeling*. In addition, many articles in these three areas are devoted to scale development and test construction. *Simulation* is the most common method used in works of *psychometrics*. The differences in methods used in the various areas of psychology reflect to some extent the unique properties and characteristics of the data collected in each research area.

Concluding Remarks

This study reviewed the 859 articles published in the *Chinese Journal of Psychology* over the past sixty years, from 1958 to 2017. Although errors and biases may occur when categorizing the research area of each article, classifying the major analytical method used in every publication, or identifying the research interests of psychometricians, the results from this study should fairly accurately reflect the scope of psychometric research in Taiwan. The field of psychometrics / quantitative psychology is relatively young and small compared to other fields in psychology. Nevertheless, this is a field of significant importance. Research on psychometrics offers possible solutions for analyzing empirical data collected in different fields of psychology. More importantly, psychometricians play a key role in equipping students with a solid training in quantitative psychology. A solid training in psychometrics furthers the proper application of statistical methods and the appropriate interpretation of results. Psychometrics is thus critical for quality research

in psychology regardless of the field and contributes to the advancement of psychological science in understanding human behavior and the human mind.

Looking forward, it is hoped that psychometric researchers in Taiwan will continue to engage in research that advances the development of various methods and models applicable to psychological data. At the same time, we expect psychometricians to establish a solid foundation for student training in quantitative psychology and encourage psychometric researchers to collaborate with researchers in other fields of psychology. In view of the critical impact of educational testing on the young generation in Taiwan, psychometricians are encouraged to communicate psychometric principles and professional knowledge to society in plain language. We look forward to constructive dialogues between psychometricians, researchers in various fields of psychology, and the general public to contribute to the understanding of human behavior and the human mind, and ultimately to the welfare of society.