A Retrospective of 40 Years of *MLRV* Publication

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To celebrate the dual milestones of 40 years of publication and also the honor of being the oldest circulating American Educational Research Association Special Interest Group journal, the current Editor of *Multiple Linear Regression Viewpoints* (*MLRV*), David Walker, interviewed long-time Editors Emeriti of the journal, Isadore Newman and Randy Schumacker, pertaining to *MLRV*'s history, motivation, use, and future.

David Walker, Editor (DW): Tell us about the history of *Multiple Linear Regression Viewpoints* (*MLRV*) in terms of how it originated, the initial editorial leadership involved, and the focus of the early volumes of the journal?

Randy Schumacker, Editor Emeritus (RS): I learned about *MLRV* from my major professor, Dr. Dennis Leitner. He and I did a paper that compared multiple regression textbooks. At first, I thought this was ridiculous, but later realized the importance and impact it had on those teaching multiple regression. I also inherited a complete set of the *MLRV* regression issues. John D. Williams published the first issue and had an opening article, "Why another Publication?" (Williams, 1970). His vision was that the journal would be seen as communication amongst researchers. His opinion was that many use multiple regression as a problem solving technique. Computers were also just arriving on the scene, so sharing computer programs was a major focal point. I remember that Southern Illinois University-Carbondale (SIU-C) had one of the first programs called DPLINEAR by Judy and Keith McNeil (Southern Illinois University Press, 1975). Another area of interest was to communicate to teachers of multiple regression. Dr. Williams also envisioned *MLRV* as a place to get particular questions answered. So, the first volume had as the Editor: John D. Williams (The University of North Dakota); the Chair of the Multiple Linear Regression (MLR): The General Linear Model (GLM) Special Interest Group (SIG) affiliated with the American Education Research Association (AERA): Samuel R. Houston (University of Northern Colorado); and the Secretary of the MLR: GLM SIG: Carolyn Ritter (University of Northern Colorado). Today, papers peer reviewed for the AERA annual MLR: GLM SIG are considered for publication in *MLRV*.

Isadore Newman, Editor Emeritus (IN): As Randy already indicated, John Williams was one of the first editors and, I believe, Joe Ward and Sam Houston were heavily involved. The emphasis of *MLRV* was to communicate ideas, concepts, procedures, computer programs, etc. for teaching regression and running unique analyses. A lot of the early presentations demonstrated how virtually all of the traditional analyses of variance procedures could be run with regression. The intent was to demonstrate how all of the other techniques were subsets of regression. At that time, this view as not as well accepted as it is now and it could not be as easily found in the traditional literature. The majority of articles in *MLRV* were not peer reviewed, but they were written by authorities in the area.

DW: As *MLRV* developed from its early days in the 1970s to, let's say its middle period in the 1980s and 1990s, how did quantitative research methodology issues and agendas change, especially given the rise of personal computers and computing power in the profession?

RS: When Statistical Package for the Social Sciences (SPSS), Biomedical Package (BMDP), and Statistical Analysis System (SAS) arrived at SIU-C in the late 1970s, many students and faculty began using the "canned" routines that were in these programs. A major issue was understanding how the programs were written and interpreting the output that was provided. Drs. Ernie Lewis and John T. Mouw in the Educational Psychology department at SIU-C wrote a companion book to DPLINEAR entitle, "The Use of Contrast Coefficients," which permitted the coding of nominal and ordinal variables, contrast coding in analysis of variance, trend analysis via coding, and repeated measures. We were now able to apply their methods using SAS. Dr. John Pohlmann further explored SAS in his classroom instruction to demonstrate how the TEST command could be used in regression for testing differences in full and restricted models as well as the significance of regression weights. As graduate students, we were well-educated about using these new software packages, analyzing data, and interpreting the output. Much of this understanding came from working in the departments, statistics lab, and helping other faculty and students.

IN: In the early 1970s, the mainframe was still the primary resource for analyzing data. The programs were very sensitive to key punching errors and fast turn-around time took two to three hours, but more typically we had to wait until the following day and felt really grateful if we could get two runs done in one day. The old stat programs like BMDP and DPLINEAR were somewhat idiosyncratic and did not have good documentation to make it user friendly. As SPSS and SAS developed with much better documentation and interfacing with applied users, they had better options of how one could manipulate data within the program. SAS had this nice option for writing test statement that produced the restricted model against which the full model was being tested. With DPLINEAR you had to write the full and restricted models and; therefore, you had to better understand the models that were being tested. It was more than just clicking a button. It was like being required to write the syntax statements in SPSS. With the advent of personal computers and the available SAS and SPSS software, some of the turn-around time was less than a minute and you could get multiple runs with multiple procedures and options. It became a totally different world.

DW: Izzy, you were a long-standing editor for the journal, what did *MLRV* mean to you and what were some of the focal points and messages that you were trying to advance in the field during your tenure?

IN: I became Editor when most faculty members perceived regression as simply correlation and; therefore, many would make comments like, "I want to talk about causal relations, not correlations." They basically confused statistical techniques with research design. Therefore, a lot of what *MLRV* was trying to communicate to the general research population was that research design was one issue, all analysis of variance can be done with regression, and one did not have to do traditional analysis of variance to be able to assume causation. What they needed was an appropriate experimental design.

We tried to look at what new topics were being introduced in the literature, such as ridge regression, boot strapping, meta-analysis, Monte Carlo studies, propensity analyses, Bayesian regression, logistic regression, etc. We also were interested in three different types of interaction: categorical - categorical independent variables, categorical - continuous independent variables, and continuous - continuous independent variables; indicating that traditional analysis of variance only looked at the first type of interactions (i.e., categorical - categorical). We also were interested in communicating how one could do a power analysis using traditional analysis of variance and also in showing that one would get the same power results using regression techniques. We also looked at the relationship between logistic regression, robust regression, and traditional ordinary least squares techniques. Talking about these techniques and reading about them in *MLRV* kept us on the cutting edge of what was happening in numerous fields. For example, this allowed us to look at the literature from path analytic approaches, structural equation modeling (SEM), and hierarchical linear regression (HLM), and it helped us to understand this particular area of literature a bit better from our framework. At all times, *MLRV* has informed me of how important it is to be very careful of how well the statistical model is reflecting the question of interest (i.e., a type VI error).

DW: Randy, as another long-standing editor for the journal, what did *MLRV* mean to you and what were some of the focal points and messages that you were trying to advance in the field during your tenure?

RS: *MLRV* has, over the years, provided an explanation and presentation of different multiple regression methods and techniques. I was looking to expand regression methods during my tenure as editor. I was interested in publishing articles on SUR (seemingly unrelated regressions) models, Monte Carlo, Bayesian regression, regression discontinuity, logistic regression, propensity score analysis, and related issues concerning interaction effects, centering, and variance inflation factor.

DW: What are you most proud about pertaining to what the journal represents?

RS: *MLRV* has and will continue to provide a journal where the many different multiple regression methods and techniques can be presented both in theory, method, and application to data analysis. The journal has a long history (40 years) of carrying out the charge John D. Williams envisioned in the very first edition: communication amongst researchers.

IN: *MLRV* presented articles that dealt with issues on the cutting edge of statistical procedures that informed the applied statistician. The articles communicated with authority and transparency in a way that most people in the area of applied research could understand.

DW: I think that *MLRV* offers a unique opportunity for scholars in that if one's paper, via peer-review, is accepted for presentation at AERA, then that paper, with corrections, will be printed in the spring volume of the journal. Tell us how this decision transpired and what this opportunity might mean, particularly, to young researchers and scholars?

RS: The vision for *MLRV* was initially to have articles "self-reviewed," but that quickly changed when so many scholars had opinions and viewpoints. The first few articles were commentary and demonstration on how to conduct multiple regression analyses. This quickly changed with computer programs that provided more exploration and application in the software options. It was soon realized that publications were important in the tenure and merit process, so papers submitted to the SIG were peer reviewed. An article that details the publication process is: Newell, Elmore, & Walker, (2012).

IN: Anyone who has had the privilege of presenting at our SIG meetings would attest to the quality of most presentations. I've been going to these SIG meeting for almost 40 years. I have never been at a meeting in which some paper presentation has not taught me something new. For 40 years, I've been impressed by what some seasoned and new scholars have been willing to share with us. I have also regretted that all of my students could not share these experiences with me. The closest I could get to sharing was to have my students read the articles presented in *MLRV* and discuss them individually or in class. From reading these articles, ideas were generated that lead to other publications and presentations authored by some of my students and some that I co-authored with students.

DW: Given that *MLRV* is focused on the general linear model, what is the future for this aspect of methodology in terms of the types of studies that you think *MLRV* will be publishing in the near future?

RS: I would like to see more applications related to partial least squares, ordinal, non-linear, Tobit modeling, and Bayesian regression methods. I think we also need to look outside the social sciences to other disciplines to investigate how they use the GLM (e.g., business, engineering, space aeronautics, medicine, military).

IN: Personally, I am very proud of my effort in changing the name of *Multiple Regression Viewpoints* to *Multiple Regression Viewpoints and the General Linear Model*. We took the position that SIGs, such as SEM and HLM, were frequently subsets of the GLM. If we accept this, then most of the techniques that seem to be on the horizon still fit under this conceptualization, which would include logistic and Bayesian regression, robust regression, generalized estimating equation, etc.

DW: What types of challenges in the methodology field await *MLRV* as it approaches 50 years of existence?

RS: I think that the different estimation methods, types of sums of squares used, and issues related to power, effect size, multicollinearity, moderation, and mediation will dominate future applications of the GLM. In addition, the clarity of selecting predictor variables will continue when examining significant beta weights, structure coefficients, commonality estimates, Pearson, part and partial correlation comparisons, and all possible sub-set methods.

IN: My major concern is that we can be assimilated because of our success. At one point in time, there was more controversy about what we were doing when compared to traditional analysis of variance. To the best of my understanding, my perspective is that the new approaches have, for the most part, basically accepted our assumptions and conceptualizations and they have re-worded them and improved techniques for making calculations or getting estimates of the basic parameters of multiple regression. For example, instead of using least square approaches they may use weighted least squares, or Bayesian, or ridge estimates. My personal bias is that we have to move from predominately using estimates of statistical significance, effect size, and interval estimations to considering testing non-nil-nulls and replicability, with an emphasis on replicability.

DW: I want to thank both of you for your stellar and long service of rigor and dedication to *MLRV* as it turns 40. Are there any final thoughts that you would like to share about the journal?

RS: *MLRV* has remained a strong journal to voice opinions about the application and use of the GLM. The GLM was well-discussed at the "Symposium on General Linear Model Approach to the Analysis of Experimental Data in Educational Research" by W.L. Bashaw and Warren G. Findley at the University of Georgia in 1967 (August 23, 1968, Final Report, Project 7-8096, Contract No. OEC2-7-008096-0496, U.S. Department of Health, Education, and Welfare, Office of Education, Bureau of Research). It gained in popularity within the social sciences once the comparison to analysis of variance became well-

established and documented in textbooks, journal articles, and software packages. The GLM, and its many applications, will remain a viable data analytic method.

IN: I am very pleased with the professional look that *MLRV* now has and am also very pleased and impressed with what Randy has done in making it accessible on-line. .

References

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