

## Factors that Affect the Physical Science Career Interest of Female Students: Testing Five Common Hypotheses

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### Abstract

There are many hypotheses regarding factors that may encourage female students to pursue careers in the physical sciences. Using multivariate matching methods on national data drawn from the Persistence Research in Science and Engineering (PRiSE) project ( $n = 7505$ ), we test the following five commonly held beliefs regarding what factors might impact females' physical science career interest: (i) having a single-sex physics class, (ii) having a female physics teacher, (iii) having female scientist guest speakers in physics class, (iv) discussing the work of female scientists in physics class, and (v) discussing the underrepresentation of women in physics class. The effect of these experiences on physical science career interest is compared for female students who are matched on several factors, including prior science interests, prior mathematics interests, grades in science, grades in mathematics, and years of enrollment in high school physics. No significant effects are found for single-sex classes, female teachers, female scientist guest speakers, and discussing the work of female scientists. However, discussions about women's underrepresentation have a significant positive effect.

### Practical/Social Implications

Teachers can employ practices that positively impact females' interest in pursuing the physical sciences. It is important for teachers to build meaningful relationships with their students. Whether

male or female, teachers should engage in building positive relationships and implementing practices found to be positive, such as the discussion of underrepresentation. Interventions should be put into place that directly counteract students' stereotypical beliefs (Dar-Nimrod & Heine, 2006; Steele, 1997) or affirm their personal values more broadly, resulting in increased engagement, grit, or confidence (Miyake et al., 2010). Perhaps engaging in discussions around underrepresentation affords more opportunities for female students' self-realization about physics because the act of discussing may incorporate their perspectives, rather than being inherently teacher centered, and help to affirm their domain belongingness, in Steele's language (Steele, 1997). By contrast, a presentation from a female scientist or simply having a female teacher is less student centered and may, therefore, be more difficult to translate into students' self-realization. In other words, explicit personal discussions regarding issues that women face in pursuing the physical sciences may help female students realize that feelings of inadequacy or discomfort they might have stem from external norms and pressures rather than from their capabilities, interests, or values.

### Citation

Hazari, Z., Potvin, G., Lock, R.M., Lung, F., Sonnert, G., & Sadler, P.M. (2013). Factors that affect the physical science career interest of female students: Testing five common hypotheses. *Physical Review Special Topics-Physics Education Research*, 9, 1-8.

## More than Appropriateness and Novelty: Judges' Criteria of Assessing Creative Products in Science Tasks

### Author

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### Abstract

The present research used a qualitative methodology to examine the criteria that judges employed in

assessing creative products elicited by two science tasks. Forty-eight responses were produced by sixth grade students and were then assessed by three groups of judges with different levels of expertise. Verbal protocol and interviews were conducted to collect data and framing analysis was used to analyze data. Overall, judges employed appropriateness, novelty, thoughtfulness, interestingness, and cleverness as their assessment criteria. Each criterion included several interpretations and the criteria were related to each other. Moreover, three judge groups differed in their use of criteria and the criteria also varied by task.

### Practical/Social Implications

Understanding the criteria for measuring creative products in the context of science is especially meaningful due to the increasing interest in the areas of science, technology, engineering and mathematics (STEM). Few studies examine creativity in the domain of science with the current standard assessment criteria. This study adds to the growing body of research that aims to understand and validate measurable criteria that are involved in the assessment of creative thinking and the cognitive processes involved. The qualitative measures described in this study can aid in the development of studies that may help to standardize the criteria used to measure creativity (e.g., appropriateness, thoughtfulness and novelty). Quantitative studies can examine if the criteria identified in this study can be used to assess creativity in other sciences tasks and across other domains. With educational institutes placing increased focus on STEM areas, it is important to understand these processes in order for educators to develop appropriate methods of curriculum and instruction.

### Citation

Long, H. (2014). More than appropriateness and novelty: Judges' criteria of assessing creative products in science tasks. *Thinking Skills and Creativity*, 13, 183-194.

## Visualizing Number Sequences: Secondary Preservice Mathematics Teachers' Constructions of Figurate Numbers Using Magnetic Color Cubes

### Author

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### Abstract

This study is about preservice secondary mathematics teachers' visualization of summation formulas modeled by magnetic color cubes representations. The theoretical framework for this research draws from studies on quantitative reasoning (Smith & Thompson, 2008; Thompson, 1995) and quantitative transformations (Schwartz, 1988). Data consist of video-taped qualitative interviews during which preservice mathematics teachers were asked to construct growing rectangles representing summation formulas. Data analysis is based on analytic induction and constant comparison methodology. Preservice teachers provided a diversity of additive and multiplicative visualizations. Results indicate that quantitative reasoning and mapping structures are fundamental constructs in establishing additive and multiplicative visualizations, hence constructing summation formulas meaningfully. Preservice teachers often had difficulties in explaining the relationships between the same-valued linear and areal quantities. They also established the rectangle condition as the essence of multiplicative visualization.

### Practical/Social Implications

The phrase "Summation Formulas" is ambiguous and somewhat misleading because although it stands for an identity of the form " $\text{Sum} = \text{Product}$ ," one gets the impression that one deals with a summation only. The main implication arising from this present study would be to replace this terminology with "Sum-Product Identities." In this way, students would first start by focusing on the words constituting this phrase, namely the fact that they are dealing with identities based on sums and products. The curriculum materials could emphasize the necessity of attending to the nature of the quantities, their units, and the quantitative operations taking place on each side of the sum-product identities at each step of the conjectural process.

Moreover, the use of magnetic color cubes as representational tools in teaching summation formulas provides students with opportunities to make better sense of, and to explore and discover algebraic connections between the sum-product identities and concrete operations. Activities that incorporate such manipulatives provide teachers with an easily accessible concept-building activity for developing sum-product identities for the summation of consecutive positive counting, even, and odd integers. These representations could also be used to model other figurate numbers.

### Citation

Caglayan, G. (2014). Visualizing number sequences: Secondary preservice mathematics teachers' constructions of figurate numbers using magnetic color cubes. *The Journal of Mathematical Behavior*, 35, 110-128.

## How Park and Recreation Agencies Engage in Community Development

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### Abstract

This study described park and recreation agency directors' attitudes towards their agencies' engagement in community development. Two hundred eighty-nine park and recreation administrators were surveyed. A questionnaire measured community development related to participants' attitudes, types, approaches, importance and engagement. Results indicated administrators believed parks and recreation are used for community development and that park and recreation agencies should conduct community development; however, certain functions central to the process (i.e., citizen empowerment training, leadership development and outreach) were not among the highest priorities. Results revealed agencies must invest in citizen empowerment and building their involvement into the community development process.

### Practical/Social Implications

Studying the levels of engagement in community development is necessary to identify current practice and areas in need of improvement. The leadership of park and recreation agencies can have a key influence on community development. Overall, park and recreation agencies should engage in community development. Types of community development that received the highest ratings included collaboration with community organizations, inclusion of people with disabilities, volunteer programming and tradition/cultural celebrations. Low-rated community development types included community members as leaders, the use of citizen advisory boards, outreach to low income residents and empowerment and diversity training.

Building community member involvement in agency leadership should become a priority for administrators. Specifically, administrators could place greater emphasis on supporting volunteer leadership training and developing citizen leadership roles so that community members may have a greater voice and roles in agency operations.

When effectively facilitated, advisory boards can increase community support for programs and services (Kraus & Curtis, 2001). Citizen advisory boards epitomize what is meant by community member involvement and leadership in parks and recreation. Given the potential to positively influence the community, advisory boards should be regarded by administrators as an important resource. Specifically, administrators should give their advisory boards substantial work to do and problems to solve. Additionally, the members must be prepared to do such work, and it is the responsibility of the agency to prepare the members through organized meetings and clear communication of responsibilities. Administrators need to listen well and take advisory board members' advice seriously. Follow-up communication should thank members for their participation and indicate how the agency will proceed with specific issues addressed by the board.

**Citation**

Skylar, S.L., Autry, C.E., & Anderson, S.C. (2014). How park and recreation agencies engage in community development. *World Leisure Journal*, 56, 281-299.

**The Effects of American Sign Language on General Self-Efficacy and Anxiety Among Mothers in a Residential Rehabilitation Facility for Drug Addiction and Substance Abuse**

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**Abstract**

This experimental study tests the effects of an intervention where recovering illicit drug- and substance-abusing mothers were taught American Sign Language as a means for improving general self-efficacy and reducing state anxiety as related to parenting their infant/child. Findings demonstrated that the experimental group exhibited higher general self-efficacy and lower state anxiety. In essence, there was evidence of an increase in the mother's efficaciousness and a decrease in state anxiety.

**Practical/Social Implications**

In continuing to examine the difficulties in language and speech development for the infant exposed to illicit drugs and substance abuse (ID/SA) in utero, ID/SA mothers and their infants were involved in a 4-week program in which American Sign Language (ASL) was taught to mothers as a parenting skill. This may provide another avenue for improvement concerning the threat to language and speech development for the infant exposed to ID/SA in utero. ID/SA rehabilitation programs are relatively simple in design and low in cost, making it easy for administrators to incorporate into existing rehabilitation programs. As one of the important needs of the ID/SA mother is parenting skills, adding parenting enhancement skills to an existing rehabilitation program has been shown to be useful (Porter & Porter,

2004). ID/SA women have lower self-efficacy and higher levels of anxiety that can influence the way they approach parenting (Brazelton & Greenspan, 2000; Velez et al., 2004; Washington, 2001). Parenting training through child development and family literacy educational programs can increase parental self-efficacy (Sanders, 1999; Tucker, Gross, Foss, Delaney, & Lapporte, 1998), as education provides the best escape from substance abuse (Bandura, 2006). This study may also help educators and health care providers better understand the diverse needs of ID/SA mothers and their infants/children. It raises awareness of the possible benefit of helping ID/SA mothers work through feelings of guilt and shame and the perception of being a failing parent (Ashley et al., 2003; Ehrmin, 2001).

**Citation**

Kissel, B.J., Rocco, T.S., Reio, T.G., Jr., & Bango-Sanchez, V. (2014). The effects of American sign language on general self-efficacy and anxiety among mothers in a residential rehabilitation facility for drug addiction and substance abuse. *Journal of Groups in Addiction & Recovery*, 9, 143-159.

**Museums and Twitter: An Exploratory Qualitative Study of How Museums Use Twitter for Audience Development and Engagement**

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**Abstract**

Museums are competing with a vast variety of Internet-based information delivery sites to keep the public interested in their institutions. To keep pace, museums are increasingly turning to the use of Web 2.0 tools to draw in the public and maintain a standing as cultural and educational leaders. Several museums have started using Twitter. The present study explores the different ways that the Hirshhorn Museum and Sculpture Garden and the



Smithsonian National Air and Space Museum use Twitter to develop and engage audiences. In this six-month qualitative study, tweets used for audience development and engagement were codified. Analyzing Twitter data suggests that the two institutions use Twitter in a consistent manner concentrating on: linking resources, creatively engaging the public to utilize new social media tools, and attempting to create an active two-way form of communication. As social media becomes more pervasive and museums adopt it for audience development and engagement, careful understanding of the advantages and disadvantages of this media need to be considered.

### Practical/Social Implications

Twitter provides museums the ability to extend communication and connect with museum patrons and social media users. Through the use of Twitter, museum staff can interact with, and engage the public using various types of tweets; including posting links to external information, retweeting information from relevant sources, announcements of museum events and solicitation of public participation in discussions. Furthermore, Twitter can be used to raise social awareness on various issues and topics. By continuing to collect and analyze data from Twitter (e.g., number of shares to other forms of social media, “favorited” tweets and retweets), museum staff can gain valuable insight into how to better market the museum’s brand and gauge the public interest in various topics. This, in turn, can aid museum curators and staff in the development of new exhibits that are of public interest, leading to increased patronage to the museum.

### Citation

Osterman, M., Thirunarayanan, M.O., Ferris, E.C., Pabon, L.C., Paul, N., & Berger, R. (2012). Museums and Twitter: An exploratory qualitative study of how museums use Twitter for audience development and engagement, *Journal of Educational Multimedia and Hypermedia*, 21, 241-255.

## Successful and Sustained Leadership: A Case Study of a Jesuit High School President

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### Abstract

The purpose of this research was to examine the factors and elements that contributed to the success and longevity of an exemplary Jesuit high school leader. Through an exemplary case study approach, qualitative and quantitative data were collected. Instead of merely employing one of two leadership frames, the convergent evidence suggested that multiple leadership frames (structural, human resource, political, and symbolic) were employed by the research participant in the service of being a unique and successful leader. The research highlighted the need to draw from several leadership frames for best success.

### Practical/Social Implications

The conceptual frameworks that guided this study are related and suggest implications for educational leadership in Jesuit high schools in urban settings. Certain characteristics of Jesuit education, such as care and concern for others and reliance on a spirit of community, resonate clearly with both the human resource and structural frames. In urban areas, the characteristics of Jesuit education that set it apart are its focus on its association with the Church and particular spirituality. Given the diversity, fragmentation, complexity, and sociocultural issues of urban places, Bolman and Deal’s (1997) symbolic frame attests to the necessity of fostering culture and a particular institutional environment, whatever that culture and environment might be. Hence, Jesuit education gives particular shape and form to the more general proclamations of Bolman and Deal’s frames.

It should be noted that urban schools, whether public or private, do not exist in a vacuum. Increasingly, the leaders of private schools, such as Jesuit high schools, will need to apply their leadership knowledge and skills to advance their institutions in

highly contested and politicized urban environments. Organizational change and effectiveness will require a certain political savvy and a mindfulness of their values and ethical principles.

#### Citation

García-Tuñón, G.M., Cistone, P.J., & Reio, T.G., Jr. (in press). Successful and sustained leadership: A case Study of a Jesuit high school president. *Education and Urban Society*. Advance online publication. doi: 10.1177/0013124514541812

of values. Errors for these two methods were perfectly correlated.

#### Citation

Traez, S.M., Newman, I., & Newman, D.O. (2014). Understanding HLM models and Type VI errors: The need for reflection. *Multiple Linear Regression Viewpoints*, 40, 23-36.

### Understanding HLM Models and Type VI Errors: The Need for Reflection

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#### Abstract

This article presents a framework for two common hierarchical linear models (HLM), instructions to run them in Statistical Package for the Social Sciences (SPSS), and a comparison between SPSS 21.0 linear mixed models (LMM) and HLM 7.0 output. Discussion topics include centering in hierarchical modeling, a comparison of SPSS output for the default restricted maximum likelihood and maximum likelihood solutions, a comparison of SPSS output for HLM and ordinary least squares (OLS) multiple linear regression (MLR) with person vectors output on mean square errors and  $R^2$ , and a comparison  $R^2$  and  $R^2$  changes. Correlated residuals between SPSS LMM and OLS MLR provide a context for considering hypothesis testing, research questions, and the choice of statistical tests. Finally, this article addresses the complexity of developing multi-level linear research questions and determining which statistical techniques are appropriate for answering those questions so Type VI errors can be avoided.

#### Practical/Social Implications

Researchers need to exert care so that their statistical analyses match their research questions and avoid making Type VI errors. Multi-level linear models with HLM and SPSS output are similar, but differences exist in the algorithms or the rounding