

Academic conference posters: Describing visual impression in pharmacy education

Sheela Khadka, Katlyn Holt, Michael J. Peeters^{*}

University of Toledo College of Pharmacy and Pharmaceutical Sciences, Toledo, OH, United States of America

ARTICLE INFO

Keywords:

Poster
Conference
Visual communication
Visual impression

ABSTRACT

Background: Academic conference posters are a key communication before journal articles. Attention to visual attributes can enhance academic poster communication.

Objective: This investigation's purpose was to create a visual impression measurement instrument, and then to describe and compare visual impression among scientific posters from an academic conference.

Methods: A mixed-approach rubric was created to quickly measure visual impression of academic posters. Then, posters from a pharmacy education conference were retrospectively reviewed and scored. Visual impression was compared for traditional versus contemporary poster-formats. Various poster characteristics (poster-format, summary statement presence, abstract presence, wordiness, QR-code presence, logical sequencing, visuals) that might have impacted visual communication were coded. These characteristics were regressed onto visual impression scores.

Results: Three-hundred seventy-eight posters were scored with sound inter-rater reliability. Contemporary poster-format scored significantly higher than traditional. Poster-format, abstract absence, lack of wordiness, QR-code presence, logical sequencing, and number of visuals were significant when regressed.

Conclusion: Posters at one academic conference had varied visual impression. While a contemporary poster-format appeared more helpful, it was not a panacea; variation from poor through exemplary was seen with both poster-formats. Posters are not text-filled articles; displaying a combination of visuals/text clearly and concisely can help effective communication with academic posters.

1. Introduction

Academic conference posters have facilitated dissemination of research for the past half-century.^{1–3} While journal articles are a predominant means of scientific communication, scientific posters at academic conferences are an early-access means for researchers to convey preliminary findings and to interact with similarly interested colleagues.¹ Additionally, poster presentations can help researchers' own professional development by fostering discussion and networking with colleagues over mutually-relevant content. Though many experienced researchers have provided perspectives on “how to create an effective poster”, there appears a very small number of empirical research on effective poster design.¹

Within these empirical studies, an instrument for quick-scoring appears needed. In one notable study by Smith and colleagues that assessed posters at an academic neurology meeting,⁴ two scoring instrument

formats were used—a detailed instrument with 17 criteria, and a single-item single-criterion “first-impressions” instrument. These researchers found that their quick scoring with the single-item instrument very strongly correlated (Pearson $r = 0.75$) with their much slower detailed-instrument scoring. This should not be surprising. While it had not discussed as such in that study, others have reported that their single-item holistic rubrics have performed similarly to their detailed analytic rubrics^{5,6} A further example worth mentioning was done with doctor of pharmacy admissions essays where a quick and simple holistic rubric performed similarly to a more detailed analytic rubric that was much slower and more complicated to use.⁷ Moreover, most poster evaluation instruments in the literature had not reported (or done?) psychometric evaluation (i.e., validity and reliability).

With the important role that poster sessions play within academic conferences, this study aimed to both create an instrument to quickly (efficiently) score many posters for visual-impression, and then to use it

^{*} Corresponding author at: University of Toledo College of Pharmacy & Pharmaceutical Sciences, 3000 Arlington Ave, MS1013, Toledo, OH 43614, United States of America.

E-mail address: michael.peeters@utoledo.edu (M.J. Peeters).

<https://doi.org/10.1016/j.rcsop.2024.100423>

Received 25 September 2023; Received in revised form 6 February 2024; Accepted 14 February 2024

Available online 15 February 2024

2667-2766/© 2024 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

to describe the visual effectiveness of posters presented at an academic conference on pharmacy education.

2. Materials and methods

This investigation was a retrospective observational study that followed the 2022 American Association of Colleges of Pharmacy (AAPC) Annual Meeting. Investigators reviewed and coded all available posters that were uploaded to the AAPC conference website for conference attendees to view (Research, New Investigator Award recipients, School, Trainee poster categories); posters that were not available virtually were excluded.

Visual Impression Rubric: Following from modern validity theory,⁸ evidence for both content and reliability would provide initial validity evidence for scores from a newly-created visual impression rubric. From a content evidence standpoint, most experts in prior literature highlighted that posters are a visual medium,^{1,3,9-15} and empirical research corroborated this.^{4,16-19} Within this reviewed literature, investigators uncovered themes of *using graphics*, *limiting text*, and *logically organizing* the poster layout. From a reliability evidence standpoint, while analytic rubrics are often better for reliability of scores, they are much slower and potentially more awkward to score than holistic rubrics.¹ So, investigators endeavored to create a mixed-approach rubric (a combination of holistic and analytic rubrics)—which can share benefits from both analytic rubrics (improved inter-rater reliability) and holistic rubrics (much easier and faster to score).⁵ Another article details how to create a mixed-approach rubric.⁵ In short (and because this rubric would be used by human raters²¹), investigators devised the four-category rubric in Fig. 1. The identified themes discussed earlier (of using graphics, minimizing text, and logically organizing) were inserted as suggestions into that mixed-approach rubric. Notably, the few categories in a holistic or mixed-approach rubric can allow judges latitude to interpret criteria as they arrive at their 1–4 score. With objectivity a myth in assessment, this rubric embraces a “shared subjectivity”²² which should be seen as a positive; it is incorporating a shared, tacit knowledge within judgments made using it.

Thereafter, two investigators (Michael Peeters, Sheela Khadka (or MJP, SK)) piloted this instrument by independently reviewing and holistically scoring each of the hundreds of posters at an annual pharmacy education meeting. Any disagreements in scoring between these investigators were resolved through discussion. For initial inter-rater reliability of visual impression scores, Cohen's kappa for absolute agreement was used when comparing scores from different raters (agree versus disagree), with kappa interpretation by Landis and Koch.²³ Additionally for each poster reviewed, a series of visual components that may impact visual impression were deductively coded [i.e., poster-format (see description below), presence of a summary statement, presence of abstract, wordiness, presence of QR-code, logical sequence like a journal-article (IMRaD—Introduction/Methods/Results/Discussion-conclusion), along with presence and total number of visuals (tables, figures, diagrams, pictures)].

Poster-formats: Two major formats of posters were coded—traditional and contemporary. Traditional posters followed a traditional IMRaD format and would be familiar to many academics who have seen this format for many years. Contemporary formats followed one of two more recent trends. Either a contemporary poster's design could follow Persky's formatting,¹⁴ (along with a general example of it²⁴), or it could follow Morrison's formatting (sometimes called a highway “billboard” design; with examples of this at these Morrison references).^{15,25}

¹ When most educators think of a rubric, they think of analytic rubric with its rows for different domains and its columns for incremental amounts of that row/domain.²⁰ Alternatively, holistic rubrics are a single row/domain for the whole (i.e., holistic), and have different incremental columns for that single/overall row.⁵

Data were analyzed using SPSS software (version 25.0. Armonk, NY). First, a Mann-Whitney U compared visual impression scores for contemporary versus traditional poster-formats (with ‘Contemporary’ especially not normally-distributed; see Fig. 2). Like Goodhand et al.,¹⁷ a linear regression model was used to assess specific visual components on the visual impression score. A Spearman's rho tested level of univariate linear association between number of visuals and visual impression score.

3. Results

Three-hundred seventy-eight conference posters were reviewed, coded, and analyzed (248 Research, 10 New Investigator Award recipients, 93 School, 27 Trainee categories). Twenty-five posters (7%) were not uploaded and so unavailable for this review.

Inter-rater reliability, using the mixed-approach rubric in Fig. 1 to score visual impression, was 0.8 (“nearly perfect”).

The mean score for all posters was 2.5 (SD = 0.9). The majority of posters (287/378; 76%) were traditionally-formatted while contemporarily-formatted posters were 24% (91/378). Fig. 2 shows distributions of visual impression scores for contemporary, traditional, and both poster-formats. Contemporary posters (median = 3, 25%–75% = 2–4) were rated significantly higher than traditional posters (median = 2, 25%–75% = 1–3), $U = 6.97, p < .001$.

Table 1 shows frequency of coded categories between traditional and contemporary poster formats. Table 2 reports the linear regression model for coded categories regressed onto visual impression scores, and the standardized betas show that visual impression scores were positively-associated with poster-format, presence of QR-code, logical sequencing, and number of visuals, while presence of abstract and wordiness were negatively-associated. Regardless of poster format, number of visuals and visual impression were correlated (Spearman rho = 0.22, $p < .001$).

4. Discussion

Investigators of this study have reported initial validity evidence for the content and reliability of scores using a newly-created instrument to quickly rate visual impression of academic posters at a pharmacy education conference. Among conference posters, investigators found that a contemporary poster-format seemed, on average, more advantageous than a traditional poster-format. However, investigators also saw that some contemporary poster-formats turned out badly, while some other traditional poster-formats were very good. Thus, the poster-format itself does not seem a guarantee of success; although, it may be that characteristics of a contemporary design (such as restrictions on space for text, prompts for QR-codes, succinct summary/take-home statements) may help the presenter during their poster creation.

Whether noting that conference attendees appear to spend about 90 s at each poster on average,²⁶ “spend only minutes”,⁹ or a “10–10 rule” that viewers/attendees will take 10 s to scan a poster at 10-ft to decide if they will approach^{14,15}—these concepts focus on visual attraction/impression first. First-impressions appears to strongly influence continued viewing. It seems prudent to develop poster content in such a way that is visually appealing and concise to attract viewers to one's poster. (This is not suggesting that poster content is not also important, but content should align and balance with visual needs.) Regarding visual balance, using *more* than one visual element appeared helpful, when the visuals were not in addition to text but replaced text and showed viewers what was meant. Using a QR-code (which may help limit words of technical details by linking to technical details for those interested), logically sequencing a poster (IMRaD sequencing and reading top-to-bottom and left-to-right, just as expected from journal articles), as well as minimizing words (by avoiding blocks of text, not placing an entire abstract on a poster, avoiding full sentences, and replacing words with visuals as much as possible), appeared to each help visual

Category	Poor	Sub-par	Acceptable	Exemplary
Organization	Neither clean nor straightforward	Much left to be desired/better	Some left to be desired/better	Information clean straightforward, organized
Poster design and use of graphics	Visually unpleasant	Much left to be desired/better	Some left to be desired/better	Visually helpful, eye catching, pleasant to eyes
Wordy or Busy	Very busy and/or very wordy, (full of text, some vague, some ambiguous)	Busy and/or wordy (majority was text, difficult to review quickly)	Not really busy or wordy (some wordiness present but can be easily reviewed/undersood)	Neither busy nor wordy, (use of bullet points, easy to review/understand)
Score	1	2	3	4

Fig. 1. Mixed Rubric for Visual Impression Score.

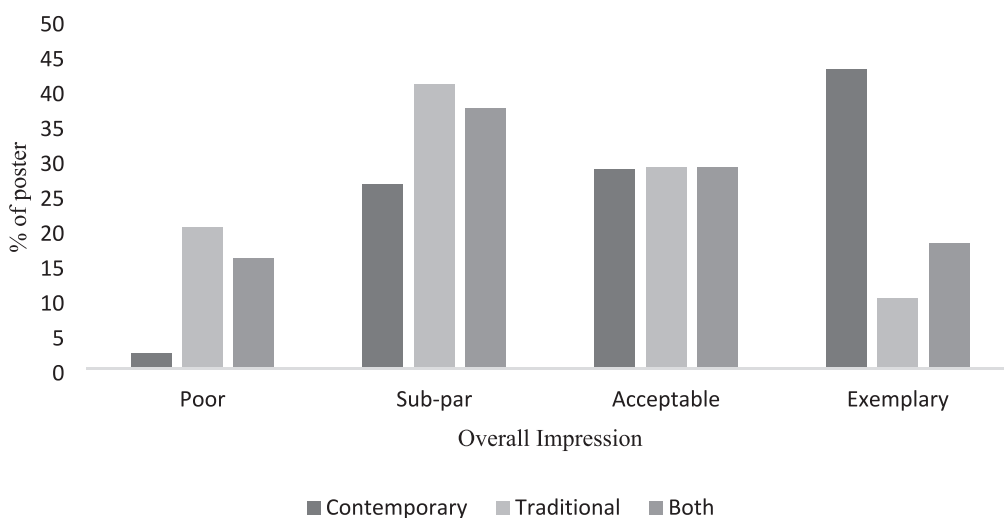


Fig. 2. Distribution of Visual Impression Score by Poster-format.

Table 1 Descriptives of Coded Categories by Poster Format.

	Traditional Poster Format	Contemporary Poster Format
Number of Posters (%)	287 (76%)	91 (25%)
Summary Statement (Yes)	11 (4%)	35 (38%)
Presence of Abstract (Yes)	13 (5%)	1 (1%)
Wordiness (Yes)	128 (45%)	23 (25%)
Presence of QR-code (Yes)	32 (11%)	29 (32%)
Logical Sequencing (Yes)	231 (81%)	57 (63%)
Any Visuals (Yes)	284 (99%)	87 (96%)
Number of Visuals	Mean = 2.0 SD = 0.9	Mean = 2.0 SD = 0.9

impression. Conversely, wordiness (with blocks of text, excessive details, and/or complete sentences with periods) and reproducing the previously-submitted abstract (which could further contribute to excess poster words) negatively impacted visual impression; the poster is an “illustrated/visual abstract”.^{1-3,11,13-16,18} and so there is no need for this redundancy.

Findings from this current study are empirical and agree with others' experience-based perspectives. For instance, as Persky (an experienced researcher) highlighted, posters should be designed to convey one main message, with overcommunication hindering reading and understanding by poster viewers.¹⁴ And empirically, a study that surveyed 65

Table 2 Linear Regression on Visual Impression Score for 378 Posters from the 2022 American Association of Colleges of Pharmacy Annual Meeting.

	Observation (% Yes)	Standardized Beta	t-value	p-value
Poster-format	24%C,76%T	0.28	5.9	<0.001*
Summary Statement	12	- 0.02	- 0.35	0.72
Presence of Abstract	3.7	-0.1	-2.3	0.02*
Wordiness	40	- 0.37	- 8.65	<0.001*
Presence of QR-code	16	- 0.12	- 2.8	<0.005*
Logical Sequencing	76	0.16	3.8	<0.001*
Any Visuals	98	- 0.02	- 0.35	0.72
Number of Visuals	Mean = 2.0 SD = 0.9	0.15	3.37	<0.001*

Model R² = 0.39; C = contemporary poster-format, T = traditional poster-format; *Significance at p < .05.

engineers and chemists on rationale for choosing which posters to view also found that, besides being familiar with the subject, a leading reason for reading a poster was if the poster was aesthetically appealing with clear, logically organized images, whereas posters with dense text steered attendees away from posters.¹⁸ A further empirical qualitative study of 89 attendees/poster presenters at a primary care conference, respondents emphasized the need for incorporation of technology, such

as a QR-code, to improve poster utility and value¹⁹; a QR-code can allow poster authors to provide more details remotely,²⁷ and to not clutter the poster itself. While sample-sizes ($n = 89$, $n = 65$) are smaller than the current study ($n = 378$), the trajectory from these different academic disciplines appear similar.

Given the current autonomy that authors have in their poster design, the subsequent wide array of viewer impressions should not be surprising. Investigators of this current study are not the first to suggest that a further degree of standardization may aid in developing effective communication skills for poster presenters.^{1,28} For example, IMRaD was a standardization for logical flow that was implemented in the 1970s for peer-reviewed journal reports.¹ It seems that it has been so successful and now commonplace, that scientists seem to expect it. Some, but not all, journal commentaries suggested extending it to logical organization of posters.^{1,3,9-13,15,20} Of note, although the studied conference organizers had suggested that authors use Persky's contemporary poster-format,^{19,29} most poster authors at this conference chose otherwise.

While the large sample size of posters was one notable strength of this study (and largest among other literature that investigators reviewed), this study has reported only initial evidence for the scoring inference of validation within Kane's Validation Framework.³⁰ Within, only two judges scored posters—one judge with decades of experience writing articles, creating posters, creating infographics, judging poster competitions, and helping trainees to create award-winning posters; while the other judge was relatively new to scientific posters and had a “fresh set of eyes”. And while they showed excellent interrater reliability in this initial study, this should also be seen as a limitation; more work needs to be done as future studies should employ a larger number and wider diversity of judges. Following after this initial report for the scoring validation inference, future investigations describing Kane's Framework for Validation³⁰ inferences of generalizing, extrapolating, and implications with this visual impression rubric warrant exploration. Additionally, the R-squared from regression onto visual impression scores suggested that there was additional unexplained variance in the data; this could be explored further in a future investigation—and perhaps the visual impression rubric could be revised. Furthermore, poster titles, which had been described by numerous authors as important to attracting viewers' attention,^{1,3,11-13} were not assessed in this study. Of note, this study evaluated posters from one pharmacy education conference during a single year, and so applicability to other poster presentation settings may be limited.

5. Conclusion

In this study, a visual impressions instrument was created and used to score academic conference posters; these posters varied in visual impression with some better and others lacking. While contemporary poster-format seemed more helpful, it was not a panacea; variation from poor through exemplary was seen with both contemporary *and* traditional poster-formats. Posters are not text-based manuscripts; displaying a combination of visuals and limited text in a clear, concise manner can help effective communication with academic posters.

CRediT authorship contribution statement

Sheela Khadka: Writing – review & editing, Writing – original draft, Visualization, Formal analysis, Data curation. **Katlyn Holt:** Writing – review & editing, Writing – original draft. **Michael J. Peeters:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial

interests or personal relationships that could have appeared to influence the work reported in this paper.

References

- Rowe N. *Academic & Scientific Poster Presentation: A Modern Comprehensive Guide*. Springer International Publishing AG; 2017. <https://doi.org/10.1007/978-3-319-61280-5>.
- Rowe N, Ilic D. What impact do posters have on academic knowledge transfer? A pilot survey on academic knowledge transfer? A pilot survey on author attitudes and experiences. *BMC Med Educ*. 2009;9:71. <https://doi.org/10.1186/1472-6920-9-71>.
- Pedwell Rhianna K, Hardy JA, Rowland SL. Effective visual design and communication practices for research posters: exemplars based on the theory and practice of multimedia learning and rhetoric. *Biochem Mol Biol Educ*. 2017;45(3): 249–261. <https://doi.org/10.1002/bmb.21034>.
- Smith PE, Fuller G, Dunstan F. Scoring posters at scientific meetings: first impressions count. *J Roy Soc Med*. 2004;97(7):340–341.
- Peeters MJ. Measuring rater judgment within learning assessments, part 2: a mixed approach to creating rubrics. *Curr Pharm Teach Learn*. 2015;7(5):662–668. <https://doi.org/10.1016/j.cptl.2015.06.022>.
- Van der Vleuten CP, Norman GR, De Graaff E. Pitfalls in the pursuit of objectivity: issues of reliability. *Med Educ*. 1991;25(2):110–118.
- Peeters MJ, Schumde KA, Steinmiller CL. Inter-rater reliability and false confidence in precision: using standard error of measurement within PharmD admissions essays rubric development. *Curr Pharm Teach Learn*. 2014;6(2):298–303. <https://doi.org/10.1016/j.cptl.2013.11.014>.
- Peeters MJ, Harpe SE. Updating conceptions of validity and reliability. *Res Social Adm Pharm*. 2020;16(8):1127–1130. <https://doi.org/10.1016/j.sapharm.2019.11.017>.
- Matthews DL. The scientific poster: guidelines for effective visual communication. *Tech Commun*. 1990;37(3):225–232.
- Murray R, Thow M, Strachan R. Visual literacy: designing and presenting a poster. *Physiotherapy*. 1998;84(7):319–327.
- Hess GR, Tosney KW, Liegel LH. Creating effective poster presentations: AMEE guide no. 40. *Med Teach*. 2009;31(4):319–321. <https://doi.org/10.1080/01421590902825131>.
- Miller JE. Preparing and presenting effective research posters. *Health Serv Res*. 2007; 42(1Pt 1):311–328. <https://doi.org/10.1111/j.1475-6773.2006.00588.x>.
- Izatt S, Dadiz R. Effective visual display of poster presentations. *NeoReviews*. 2015; 16(4):e203–e210. <https://doi.org/10.1542/neo16-4-e203>.
- Persky AM. Scientific posters: a plea from a conference attendee. *Am J Pharm Educ*. 2016;80(10):162. <https://doi.org/10.5688/ajpe8010162>.
- Faulkes Z. The “wall of text” visual structure of academic conference posters. *Front Commun*. 2023;8:1063345.
- Oronje B, Morrison M, Suharlim C, Folkman K, Glaude-Hosh A, Jeisy-Scott V. A step in the right direction: billboard-style posters preferred overall at two conferences, but should include more methods and limitations. *Qeios*. 2022 <https://doi.org/10.32388/P7N5B0>.
- Goodhand JR, Giles CL, Wahed M, Irving PM, Langmead L, Rampton DS. Poster presentations at medical conferences: an effective way of disseminating research? *Clin Med*. 2011;11(2):138.
- Patience GS, Boffito DC, Patience PA. *Communicate Science Papers, Presentations, and Posters Effectively*. 1st ed. Academic Press; 2015.
- Soon CL, Tudor CL, NG CJ, Tan NC, Smith H. What is the utility of posters? Qualitative study of participants at a regional primary healthcare conference in Asia. *Med Sci Educ*. 2022;32(6):1405–1412. <https://doi.org/10.1007/s40670-022-01657-z>.
- Peeters MJ, Schroeder MN. Creating and using rubrics. In: Hughes PJ, Thomas MC, eds. *Essentials of Pharmacy Teaching and Learning: A Practical Resource for the New Pharmacy Academic*. American College of Clinical Pharmacy; 2023.
- Peeters MJ. Measuring rater judgment within learning assessments, part 1: why the number of categories matters in a rating scale. *Curr Pharm Teach Learn*. 2015;7(5): 656–661. <https://doi.org/10.1016/j.cptl.2015.06.015>.
- Ten Cate O, Regehr G. The power of subjectivity in the assessment of medical trainees. *Acad Med*. 2019;94(3):333–337. <https://doi.org/10.1097/ACM.0000000000002495>.
- Landis JR, Koch GG. The measurement of observer agreement for categorical data. *Biometrics*. 1977;33(1):159–174.
- Rose TM. An illustrated guide to poster design. *Am J Pharm Educ*. 2017;81(7):6423. <https://doi.org/10.5688/ajpe8176423>.
- Morrison M. Better Scientific Posters. Center For Open Science. Published March 24, 2019. Accessed Nov 20, 2023 <https://osf.io/6ua4k>.
- O'Connor M. *Writing Successfully in Science*. 1st ed. Routledge; 1991.
- Hutchins BI. Embed dynamic content in your poster. *Sci Signal*. 2013;6(260). <https://doi.org/10.1126/scisignal.2003623>. tr1.
- Gopal A, Redman M, Cox D, Foreman D, Eley E, Fleming S. Academic poster design at a national conference: a need for standardised guidance? *Clin Teach*. 2017;14(5): 360–364. <https://doi.org/10.1111/tct.12584>.
- AACP Annual Meeting. Abstracts/Posters Style Guide & Formatting Checklist. Accessed May 12, 2023 <https://www.aacp.org/article/pharmacy-education-2023-submission-information>.
- Peeters MJ, Martin BA. Validation of learning assessments: a primer. *Curr Pharm Teach Learn*. 2017;9(5):925–933. <https://doi.org/10.1016/j.cptl.2017.06.001>.