The author presents some of the basic criteria for evaluating current research literature. Given these guidelines, he further aims to stimulate the anesthetist into participating in valid research projects.

I am sure that many of us at times have found the reports in journals to be baffling at best and a myriad of figures, jargon, and graphs at worst. For the researcher who sincerely wishes his information read and the findings applied, the feeling of hopelessness is mirrored. The fact that scientific journals are often inundated with research material is readily demonstrated by browsing through any issue of the last ten years or so.

In surveying issues of the *AANA Journal* dating back to January, 1960, this writer was unable to find any articles on how to read, interpret, and most important, how to utilize new research findings. A dichotomy seems to exist between the producers of research literature and the consumers of that material.

We can see readily that the quantity of reading material related specifically to our field is voluminous. In recent years, anesthesiology has taken its place in medicine and the scientific community at large in “producing” new knowledge. The societal dictate of “publish or perish” appears to have firmly rooted itself in the medical community, and anesthesia literature has not been spared the onslaught. Under such a mandate, we unfortunately find a sizeable amount of what could be termed “garbage literature” turning up, in some cases, as frankly erroneous research reports.

Bearing this in mind and in an effort to encourage the nurse anesthetist to engage actively in meaningful research, this paper is aimed as a brief guide to both reading and writing research reports. This small contribution to the “literature” I hope will cast some light on the topology of research writings and if my goal is realized, will aid those readers who heretofore have found this subject blase.

**Components of a research article**

Usually, the first thing that attracts you to an article is the title. What makes you notice a title? Was there something “catchy” about it, a play-on-words maybe? If so, then one author suggests caution and skepticism are in order while reading the report. What motive did the writer have for needing to catch your eye? Ask yourself if the title is saying something believable. A good title is descriptive and short, period.

Associated closely with the title, both in proximity on the page and because it is the author’s work, is the author’s name, as well as the names of his collaborators. Many persons glance past this important information. The current trend is to include a short biographic sketch about the researcher.
The question can then be asked is the author qualified to do the research in a believable way? Does the author regularly submit papers on a wide variety of subjects? Very few persons stray far from their chosen fields, unless they have come under the spell of “publish or perish.”

We should also question the factor of possible influence based on the author’s position—ask yourself, are any vested interests being served? Is the author what is termed an “industrial prostitute”? Such persons will do research on almost any subject as long as they are gaining notoriety and/or money. Some researchers (so-called) may be concerned with fame in terms of quantity of published material.

From here, we move to the abstract of the article. Obviously, reading the abstract will inform the reader if the entire report merits more than a cursory glance for his or her own information. The abstract should focus on the what, why, and how—what the study is about, why it was done, and how it was done. Specifically, look for a purpose statement, a description of participants, a brief explanation of what the subjects did, and a summary of the important results. Vagueness in the abstract could foretell of a grim voyage through the remainder of the report. After reading the abstract, the reader should note whether or not the title reflected the purpose of the paper in some way.

If, after reading the abstract, the reader decides to move ahead with the report and add, subtract from or merely supplement his knowledge, the introduction is read next. A mandatory requirement of the introduction is that it contain a succinct review of the pertinent literature. The literature search will point to the purpose of the investigation. Ideally, by the end of the literature review and prior to the purpose statement, the reader will have determined the purpose for himself.

If the study has a hypothesis offered (and a hypothesis is only mandatory in experimental studies), the literature review should include information both supportive of the hypothesis and that which would serve to supplant the proposal. As a point of reference, hypotheses are never proven one way or the other, they are tested for validity, that is, whether they are true or false in a given situation. The majority of modern research projects are undertaken as an extension of work others reported. Watch out for the study which has a poorly documented literature review—it could foretell of shabby data collection to come.

The introduction, if it is done correctly, will include the problem stated as a question. This question will clearly show two variables, an independent variable and a dependent variable. The dependent variable would be expected to alter in value as intentional changes are made in the independent variable.

**Methodology of the study conducted**

An explanation of the methodology used to conduct the study and collect the data follows next in the report. The method must explain who the subjects are, how they were selected, how many there are, and how they were compared. Any materials used to collect data, instrumentation employed, instructions given, questionnaires used, drugs given, and so forth should be stated. This is not the time for brevity in the report. Numerous other variables could turn up here if the methods do not preclude them. One needs to know who actually collected the data (bias), how, and over how long a time period. Research designs are never perfect; hence, it is important to explain accurately what was done and to explain its efficacy in the discussion section.

Clarity in the methodology is the key word here—no ambiguity can be accepted lest the study be non-reproducible by other workers. Questions the reader should ask include: Is the sample valid? Can the sample give adequate responses to be considered as data? A far-fetched example of non-validity
would be using a male sample to study
the female reaction to a given stimulus.
Far less obvious examples of non-
validity do occur, and studies have been
reported which were non-valid.\textsuperscript{12}

The sample must be representative
of the population one wishes to study—
that alone dictates the lower limit of
sample size. This sample size problem
is termed the \textit{reliability}—the ability to
obtain similar results if the whole sam-
pling population were polled. Hence,
one can see that large samples properly
polled usually provide for generaliza-
tions to be made about the data. Another
way of saying this is, large samples re-
duce the incidence of chance occurrence
causing the results, but this is discussed
later.\textsuperscript{18}

Sample size is generally limited by
both the number of samples actually
available and the funding available to
locate these samples. To a lesser degree,
time plays a factor in assembling a sam-
ple population. A rough rule-of-thumb
for would-be researchers is to use sam-
ples of at least 30 subjects when dealing
in the behavioral sciences.\textsuperscript{14} Results of
such a small sample, however, would be
only indicative of something, not defini-
tive.

In work dealing with human sub-
jects, control of variables is exceedingly
difficult,\textsuperscript{15} and may actually invalidate
the findings of the study. The researcher
should explain in his methodology how
he controlled the variables against un-
due influence; and if he did not ade-
quately do so, a statement to this effect
must appear in the discussion. If any
subjects were lost, killed, or died during
the study, the author must state this and
explain why in the discussion. If he
does not and you find \(x\) subjects sam-
pled but data available on \(x-1\) subjects,
ask why!

The results of the sampling and
data collection are presented next in
the paper in text form.\textsuperscript{16} Read this sec-
tion carefully and look at the graphs
and tables closely. Be sure the informa-
tion presented is the same in all graphic
and tabular representations, and that it
is in agreement with what is being said
in the text. Distrust the graph with no
numbers and any sectional graphs, espe-
cially without the zero points designated.
Compare the methods used with the re-
results you would expect.

I recently read a report in which
the researcher obtained the pulse rate by
palpation, but reported his results of
pulse changes to the hundredths place
mathematically—calibrated fingertips?

Graphs can be made to look sig-
nificant based on how the information
is presented. Bar graphs should always
be the same width, allowing the lengths
to vary. Otherwise, the overall area of
the graph increases greatly, and to the
eye, makes the data \textit{look} more signif-
icant that it really is.\textsuperscript{17} Also what are
being compared, numbers or percen-
tages? Comparing numbers is virtually
useless, and dealing with per cents is
useful only if the subjects are the same.

Exceeding the point of diminishing
returns is not seen frequently in anes-
thesia but needs to be mentioned. Sup-
pose \(A\) causes \(B\) to occur and more of
\(A\) causes even more of \(B\) to happen. This
sounds good especially if one is talking
about money but what about rainfall?
With enough rain, floods come. Like-
wise, with nitrous oxide. If a 50% con-
centration yields mediocre analgesia, and
75% would give better analgesia, there-
fore 100% nitrous oxide gives the best
analgesia. It may be true, but who would
use such knowingly? Simple examples,
but plain enough.

If a questionnaire was part of the
data collection technique, look for an
indication of returns. Less than a 51%
response to a questionnaire is consid-
ered insufficient for meaningful results.\textsuperscript{18}

\textbf{Statistical methods}

Statistical methods involved in
analyzing data are beyond the scope of
this article. However, suffice it to say,
that statistics are used to reduce and
summarize the data collected, and merely
show a greater or lesser probability of
the results being accurate when applied
outside the study.\textsuperscript{19}
The report should include a level of significance by which the researcher determined whether the results were worthy of note. A rule-of-thumb about levels of significance is that unless otherwise stated, a value greater than 0.05 should not be accepted and often a smaller value is in order. A level of 0.05 indicates that there is a 5% possibility (5 chances out of 100) that the data described could have been a chance occurrence. The report should indicate the acceptable level of chance—if it does not, wonder why!

Levels of confidence are the reciprocal of levels of significance—that is, a 0.05 level of significance is equal to a 0.95 level of confidence. That indicates that the reader should be able to believe that the data would be correct 95% of the time and a chance happening only 5% of the time. The statistical method used to arrive at these levels is based on sample size, and hence includes a correction factor.

Averages are entities we work with almost daily, yet most people assume an average indicates an arithmetic mean, which is only one of many different types of average. Other commonly used averages are the mode and the median.

(Figure 1.) The mean is derived from summing up the values of x-numbered items and dividing by x. The mode is the most often occurring value, and the median is the value with an equal number above and below its ordinated position. A good research report will tell the reader which average is being applied.

Findings

In discussing the findings, the researcher is given considerable freedom relative to the rest of the report. He must, however, apply the results to the hypothesis, if any, or to the question asked originally. Frequently, the conclusion is combined under the discussion for ease of narrative. The researcher can describe how his findings fit into the schema of present knowledge. He can make recommendations, personal judgments, as well as generalizations but only as long as they are supported by the findings.

The reader must stop and ask, has the subject been changed due to some extraneous findings? Is the author trying to capitalize on these serendipitous findings—that accidental discoveries which may be more important than the results of the actual study? Honest re-
searchers give "chance" credit and point out that, due to the incidental findings, more work needs to be done in the area.

Along these lines, any weaknesses or limitations of the study should be brought out now, such as method, design, sampling, and data analysis. This is to allow others to benefit from mistakes—avoids trial and error research, which is not research at all. Any failures must likewise be reported to aid others in not repeating fruitless work. These and any other limitations in the study must be explained, lest the reader come to believe the design technique was infallible.

Finally, question whether the conclusion can be drawn from the data analyzed. Be suspect of a dogmatic emphasis placed on any one point. Is a "hard-sell" in progress, and if so why, what is the motive? Good research speaks for itself.

The summary of the research article is the last narrative in the report and, along with the title and abstract, may be the most often read part. Accuracy here (as with the rest of the report) is essential. Included in the summary must be a brief statement of the problem and explanation of methodology, important results, conclusions, and any implications the study may have for the community with which it was written. The summary should be in clear, simple English commensurate with the subject matter and will not include statistics.

The author should make no recommendations here.

Conclusion

It is the opinion of this author that in the ensuing years, more and more nurse anesthetists will actively engage in original research and also reproduce studies. This article was undertaken in an effort to clear up some problem areas and point up others which should be questioned when reading, and for that matter, writing a research paper.

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