The salutary changes in student acceptance of the course may be due to cooperative learning, to concomitant innovations, or to other factors such as the renewed enthusiasm of the instructor. In any case, favorable student reaction to team activity (and to weekly quizzes) and enhanced student attitudes conducive to learning are consistent with published findings about effects of the procedures as employed with younger students (Slavin et al. 1985). Cooperative learning procedures have proven to be feasible for a statistics course at the university level and appear to be sufficiently promising to warrant wider use.

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A COMMENT ON O'CINNEIDE

I am writing this regarding the article by O'Cinneide (1990). Page and Murty (1982, 1983) published an elementary proof of the inequalities presented by O'Cinneide. It is surprising to see that neither O'Cinneide nor the reviewers of his paper gave a reference to our articles. The *Two Year College Mathematics Journal,* in which our articles were published, is a journal published by the Mathematical Association of America, and its current name is *College Mathematics Journal*. Page and Murty received the George Polya Award for their articles, and the articles contain proofs of several other inequalities interesting to teachers of statistics.

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MEAN MINUS MEDIAN: A COMMENT ON O'CINNEIDE

For a population with mean μ and standard deviation σ, O'Cinneide (1990) shows that for $0 < p < 1$

$$|x_p - \mu| \le \sigma \max\left(\sqrt{\frac{1-p}{p}}, \sqrt{\frac{p}{1-p}}\right),$$

where x_p is a quantile of order p. It may be worth noting a more general result. If $x_1, \ldots, x_n$ are any n numbers, then it is known that

$$|x_{(r)} - \bar{x}| \le s \max\left[\left(\frac{(n-1)(r-1)}{n(n-r+1)}\right)^{1/2}, \left(\frac{(n-1)(n-r)}{nr}\right)^{1/2}\right],$$

where $x_{(r)}$ is the rth order statistic, $\bar{x} = \Sigma\, x_i/n$, and $s^2 = \Sigma\,(x_i - \bar{x})^2/(n-1)$ (see, for example, David 1988, ex. 5 and references). This gives the stated result when $n \to \infty$ with $r \sim np$.

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ANOTHER COMMENT ON O'CINNEIDE

The trouble with this proof is that at the end the student will not have gained much understanding of why the result holds. Also he or she will not be familiar with analysis of variance at the stage that this inequality is encountered. I suggest that the opportunity should be taken of introducing Jensen's inequality, namely $f(E(Y)) \le E(f(Y))$ whenever f is convex with equality only if f is linear with probability 1. This is very easy to prove (see Feller 1966, p. 151). Then we can present the following string of equalities and inequalities (see Mallows and Richter 1969), where μ is the mean and m is the median:

$$|\mu - m| = |E(X) - m| = |E(X - m)| \le E|X - m| \le E|X - \mu| \le \sqrt{E(X-\mu)^2} = \sigma.$$

For the first inequality, take (in Jensen) $f(y) = |y|$, $Y = X - m$; we have equality only if X concentrates on $(-\infty, m]$ or $[m, \infty)$. For the third inequality, use Jensen again, with $f(y) = y^2$, $Y = |X - \mu|$; we have equality only if $|X - \mu|$ has one-point support. The middle inequality results from the fact that any median minimizes the average deviation, which is again something that students should hear about; see Blyth (1990), Schwertman, Gilks, and Cameron (1990). Here we have equality only if the mean is also a median. Putting this all together, we have $|\mu - m| = \sigma$ only in the symmetric two-point case.

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BOUNDS ON QUANTILES: A COMMENT ON O'CINNEIDE

Let X be a random variable with mean μ and standard deviation σ. Suppose $0 < p < 1$ and $q = 1 - p$. A p quantile x_p of X is defined by

$$\Pr(X \le x_p) \ge p \quad \text{and} \quad \Pr(X \ge x_p) \ge q. \qquad (1)$$