

36. Educators also, especially those interested in visual education, and lately those interested in the education of the crippled and blinded, and all other types of the handicapped, have appreciated the emphasis on the *accuracy* of the original record, the *usefulness* of the standard method of getting the one best way to perform the work, and the *teaching value* of the method embodied in these standards.

37. The indictment of education against the unnecessary inefficiency of stop watch time study has not yet been fully made. It is the most serious of all indictments, and will cover not only the things that have been done that should not have been done, but also the things that have not been done that should have been done.

38. Stop watch time study has, to all effects, recognized the validity of the psychological criticism. This may lead to the anticipation of further educational criticism and to changes in method that will tend to avert this, and also criticism from the ethical standpoint. Another present need seems to be a realization of the value of criticism from the standpoint of the science of statistics, which we present here.

39. This indictment is made primarily upon the use, throughout the entire process of making and using stop watch time study, of that which is "average." In the first place, it is customary to make records of the "average worker" or "one slightly above the average," and some advocates of the stop watch recommend making records only of the indefinite "first-class man." As a matter of fact, there is no such thing as an "average man," and if there were it would require much research to determine and to locate him. The border lines of defining the "first-class man" are as indefinite as the location of a rainbow. There is but one type of worker that is fixed, at least for the time being, that is *the best man obtainable at the time*; at that particular kind of work. This may in reality be represented by the synthesized work of several of the best workers. The synthesis of a best method is obviously impossible with the stop watch methods or with data taken on "average" workers. Any data taken from observation of an "average man" are sure to be inferior to the best method used by the best man obtainable. All scientific methods are based upon the utilization of the best obtainable, and an ideal to come to; such an ideal obtained from the most skillful, and not from the average, is always an inspiration for further attention, effort and learning to everyone—apprentices, learners, workers and teachers. The great principle of having an ideal of method toward which

each one is to approach, as near as his capabilities will permit, is entirely lost by those who depend upon averaging times or methods which have been inaccurately observed and inadequately recorded and then averaged.

40. It must here be emphasized that having an ideal of method is something entirely different from having an ideal of "*speed with which work is to be done*," or as it has been sometimes worded, "*the time that it takes to do work*."

41. The allowance to be figured for calculating the task is more easily figured with relation to the standard man or best man obtainable at that particular kind of work—the most expert worker—than with relation to an unscientifically selected worker, who is guessed to be an "average man" or to be an indefinite "first-class man."

42. It may be possible that in some organizations the "average worker" is still selected for such observation, not because he is supposed to be easy to find, but because it is erroneously supposed that workers will approve of the "average" in efficiency being observed, as typifying what is to be expected of them. The students of labor problems, both in and out of the ranks of labor, realize today that education of the worker is the greatest need, whether or not he will participate in the management, and no form of education for the worker has surpassed that of showing him the micro-motion study records and the simultaneous motion cycle charts of the methods of the best man obtainable. All workers have far too little time to study, and therefore they do not desire to waste time studying the methods of the "average man," or anyone else other than the best. Neither is it necessary that observations be made of the "average man," nor of the man "a little above the average," nor of "the first-class man" for the purpose of setting proper and achievable tasks and in order to make proper planning programs, because, regardless of the source of the data, the task, or quantity of the program, must be set at that point which is achievable by the worker who is actually put to work at it, or the task idea in management will do more harm than good. As a matter of fact, the workers in this country and in the countries abroad, as they come to appreciate the value of real standards and the accompanying benefits to them from better management methods as a means of increasing the purchasing power of the results of their labor are *demanding not*

<sup>22</sup>"Psychology of Management," page 152.

only that they themselves shall be allowed to take part in the investigations as well as in the application, but they are also in favor of the highest degree of accuracy in the recording process. There has not been an instance in our experience where workers have failed to appreciate the accuracy of the recording devices, when this was brought to their attention, nor have we failed to have them realize that the methods which are being recorded ought to achieve the same degree of perfection that the recording devices have already reached. Furthermore, it should always be realized and emphasized that the primary interest is in the problem of obtaining correct fundamental data, in such form that they can be transferred to and used by others and not merely data for temporary, makeshift task purposes, but for a permanent plan of cumulatively perfecting standards, ever holding and improving upon the best way known.

43. This criticism of the use of the "average" is sustained by the laws and best practice of the science of statistics. Statisticians also lay down certain fundamental requirements for proper records, which stop watch time study does not meet. We quote from several recent books by authorities on economics and statistics, who maintain that in order to be worth while:

44—1. There must be the greatest care in recording *quality*. King, in his "Elements of Statistical Method," page 32, section 17, says, "One of the shortcomings of statistics is that they do not always bear on their faces the label of their quality." It is evident that stop watch time study fails in this respect.

45—2. Accuracy is imperative.

(King, page 33, section 18: "The value of statistics depends primarily on the accuracy of the figures.")

(Horace Secrist, "An Introduction to Statistical Method," page 27: "The difficulty is not necessarily one of error in reporting (yet undoubtedly this is an important factor), nor in the accuracy with which such facts *might be determined*, but rather with the accuracy with which they are determined under the conditions of collection.") We have noted that it is impossible to take accurate records of small units by the stop watch method; in fact, the smaller the units the greater in proportion is the error, yet the scientific method always demands the examination of the smallest units possible.

46. Also King, page 76, section 46: "The total can be no more accurate than its most faulty item." And again, King, page 77, section 47: "The absolute accuracy of a total can be no greater than that of the

most inaccurate item composing it." Therefore, since the original data are inaccurate, stop watch time study cannot hope for accurate results, no matter how it handles them or how it "works up" the observed times.

47—3. Individual differences must be noted. (King, page 35: "Statistics from the very nature of the subject, cannot, and never will be able to take into account individual cases. When these are important other means must be used for this study.") "Individual cases" in time study are important, for from the study of them and investigations of the causes we often find clues to better methods.

48—4. No mathematical accuracy will compensate for inaccuracy of fundamental data. (King, page 70, section 44: "An exceedingly common error is to give to figures a large degree of fictitious accuracy which arises simply from some mathematical operation. One must guard against such fictitious accuracy whenever numbers containing decimals or giving a decimal as the results are multiplied, divided, raised to a power or the root extracted.") We have already noted the mathematics of determining times, and note here the dangers in their use.

49—5. There is no assurance of increasing accuracy by increasing numbers of observations, if the method is not accurate. (King, page 62, section 38: "It is better by far to have a small number of correct samples than to have a large number of incorrect ones.") Not even the accumulation of a large amount of data will make stop watch records accurate even ultimately. Merrick states that his curves, on page 17 of his book, are "based on the data from a vast number of time studies," but it was non-recordable, inaccurate, unsynthesizable data of the stop watch method.

50—6. The unit to be observed must be accurately determined. (King, page 46, section 25: "Not only must the unit selected be defined with precision, but it must also be of such a nature that it may be correctly ascertained.") This is impossible with stop watch time study.

51—7. The greater the number of items observed, the more danger, if the records are not accurate. (King, page 75, section 45: "When the number of items is larger, compensating errors, if relatively small, are negligible, but, on the other hand, cumulative errors always seriously affect the accuracy of the total or the average.") This shows that the faith put by the makers of stop watch time studies in number of observations is not well founded.

52—8. The *average* is not only *not* accurate, but