WORK SAMPLING COMPARATIVE AMONG CONVENTIONAL, SELF ASSESSMENT, AND CONTINUOUS MONITORING METHODS TO MEASURE PROPORTION OF NON PRODUCTIVE ACTIVITIES

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ABSTRACT

This research was done to compare three methods, i.e., conventional, self assessment, and continuous monitoring methods in measuring non productive activities in Bureau of Administration and Student Affairs (Biro Administrasi Akademik dan Kemahasiswaan - BAAK), Gunadarma University. Pre research was conducted to measure non productive activities using conventional method. Self assessment was conducted using questionnaire as research instrument, handy cam was used to observe work activities in the same period of time as the two methods mention before. Hypothesis tested toward non productive activities among the three methods using paired t- test. The result shows that conventional and continuous methods measured non productive activities significantly different. The result also shows that continuous method measured non productive activities significantly different with the one measure by conventional and self assessment methods.

Key words : work activities, conventional method, continuous method

INTRODUCTION

Services performing by Bureau of Administration and Student Affairs (Biro Administrasi Akademik dan Kemahasiswaan - BAAK) Guna-darma University for campus located in D, E, G, and H are centered in D area, building 4, floor 1. Services perform either on-line nor off line. Services off line employ human resources, which is interact face to face with student as customer.

One of the consequences of interaction is queuing. Queuing is unwanted condition by every customer. Queuing can be reduced by analyzing existing work system and designing better work system if needed.

The objective of this research is to compare non-productive activities ratio measured by three methods, i.e. conventional method, self report, and continuing controlling.

THEORETICAL BACKGROUNDS

Work Sampling

L.H.C Tippett is the first time of using work sampling method. The method was used to observe textiles industry worker. In 1940, work sampling also known as delay ration of activities. Work sampling is a tool used to find facts. In most cases, work sampling can reduce cost and time spending for production (Barnes, 1980). Niebel (2003) defined work sampling as technique used to measure productive activities proportion..

It's advantage compares to conventional method (Barnes, 1980), is suitable to use when dealing with lot of activities with non practical measurement. Using work sampling is possible to observe more than one operator or machine at the same time with one observer. On continuous time studying, usually one observer needed for one operator/machine.

Work sampling also more efficient compare to continuous time studying based on work time and cost. Cost can be reduced until 5-50% of continuous time studying cost. Observation is possible be conducted in day range or week, but it'll give impact on data variance. Work sampling doesn't need a time study expert in conducting sampling, except performance sampling needed. When standard time or performance index expected, a time study expert is needed. Even though there is possibility disturbance on work sampling method, the result will not be effected significantly.

Work sampling measurement can be conducted in varies interval confidence. Using work sampling, quick observation toward operator can be done in random interval.

Employing quick observation can reduce unimportant observation.

There three advantages of work sampling according to Wignjosoebroto (1992). First advantage is to measure delay ratio of activity. Second advantage is to measure performance level based on working or delay status, particularly for manual work method. Last method advantage is to identify standard time of an operation.

Worker with high level commitment continuously conduct work sampling to measure their performance (Niebel, 2003). For most of self report case, it's found that worker spend smaller portion of their time to do important things, as they think do. As reverse, they spend more time on unimportant things, such as delay or postponing something unimportant beyond their prediction.

Work sampling also can be done using varies tools or supporting equipment, such as moving camera recorded with 1000 picture per minute accuracy. Another tool is electronic equipment with code used to translate directly to computer daily, weekly, or monthly. Another is portable picture recorded known as handy cam.

Video camera is usefulness to produce un bias work sampling (Niebel, 2003). On observation spot, data collected tend to be bias if sampling study done toward individual or group performance. The existence of an observer is possible in raising disturbance toward operator activity on work condition. There is tendency to work motivated when an observer as observer comes to close. Bias can be produced by an observer when he/she write what have been happened or will happen.

RESEARCH METHOD

This research need some tools, i.e. video camcorder SONY video hi8 ccd-trv418e (1 unit), and stopwatch. This research also used materials such as video hi8 cassette, pen, and observation form. Video and cassette used to record all activities when continuous observation method applied. Pen and observation form used when self assessment and conventional methods were applied. Stopwatch was used when conventional method was applied.

Data used taken from three sources, according to method applied. Conventional work sampling employ random number table as a measurement of time. Based on randomize level and quantity of observation (n) predefined, observer make sign on observation form in suitable cell.

Research variable are productive and non productive activities. Productive activities divided into 5 categories, i.e. keying, pointing, reading, writing, and handling document. Non-productive activities differentiate into two categories, i.e. allowance (rest, personal activities, praying, eating, drinking, etc.), and unemployed.

Data Collection Technique

Data collected using observation method. Sample quantity to be collected on first day is calculated based on quantity of pre observation divided with total of observation days (N-1). Sample quantity on second day equal to total of sample on pre observation and first day divided by N-1. Interval confidence used is 95%, or significance level of 5%.

Self report filled 5 days continuously, with 4 hours range productive time. Worker asked do fill out given form 30 times a day. The time schedule to write the activities was decided by worker. Random table is not used to decide when the activities should be written.

Continuous activities recorded using a handy cam at 09.30-15.00 o'clock, during 5 days work days (excludes Saturday and Sunday). Recording is playing as long as 90 min. time range 90 min is chosen in order to simplify calculation. For 5 days observation, 450 min each day, will be resulted 9005 observation. Sample to be observed was chosen randomly.

In second measurement, the observation will be in 27.000 seconds duration. Using 3 seconds range, the observation was written to a form provided. T overcome bulky data, productive and non productive activities is drawn using tally diagram.

Data Analysis

Hypotheses test is used to compare the three methods.

RESULT AND DISCUSSION

Conventional Work Sampling

Pre work sampling was done as much as 61 times, with 4 minutes interval. Observation was started at 09.00-11.30, continued at 13.02-14.58.

The summation of allowance and unemployed activities result non productive activities proportion as much as 0.2131. With q value from pre studied, sample quantity (N) needed for next observation using confidence interval 95% (or significance level 5%) is 258 samples.

Observation time was decided 5 days. On Saturday, student services is open from 09.00 - 12.00 o'clock, shorter than other days. As result, division factor for first day only 4.5 days. And so observation frequencies for first day are 44 samples (N_1).

Using random table, 95 random numbers were resulted. Every number is used mutually exclusive. Based on mutually exclusive property, from 95 numbers were resulted 33 numbers. The 11 numbers remain were searched using other random numbers. The activities performed on day one is shown on Table 1.

Table 1. Frequencies of performing activities

Day	Productive activities					Non productive	
	keying	pointing	reading	writing	Handling document	Allowance	Unemployed
Conventional methods							
0	11	3	6	6	22	5	8
1	6	2	2	5	17	4	8
2	7	2	3	4	21	4	9
3	8	7	3	2	17	4	11
4	9	8	6	3	19	5	8
5	5	1	4	0	5	4	4
Total	46	23	24	20	101	26	48
Self report							
	39	36	35	16	99	21	29

Table 2. Frequencies of non-productive activities using continuous method

Day	1	2	3	4	5
Non productive activities	1060	765	991	995	688

Non productive activity on day one (p_1) is 0.2727 and productive activity (q_1) is 0.7273. With p value from predetermined research, proportion total of activities non productive on day one ($\overline{p_1}$) is 0.2381.

Sample size needed for 95% confidence of interval is change, becomes 279 and observation total for day two (N_2) is 50 sample. Proportion of non productive activity on day two was calculated as much as 0.26, and so productive activity is 0.74. Given p and p1, proportion mean of non productive activity on day two ($\overline{p_2}$) is 0.2451. Proportion total of productive activity on day ($\overline{q_2}$) then becomes 0.7549. Samples size (N) needed for 95% of interval confidence is 285 unit and 52 observation sample on day three (N_3).

Using random table as before, after deleting duplication random number and outside range, observation time was resulted 52 times on day three.

Proportion of non productive on day three (p_3) is 0.2884. This fact resulted productive activities proportion on day three (q_3) is 0.7116. Given p, p_1, and p_2, Proportion total of non productive activities on day three ($\overline{p_3}$) is 0.2560. And so, proportion total of productive activities on day three ($\overline{q_3}$) is 0.7440.

Based on data until day three, sample size (N) needed for 95% confidence of interval (or 5% of level significance is 293 samples.

Frequencies of observation for day four (N_4) is 58 sample. As done before, random table used and started from 508 sequences until 856. Having eliminates chosen random number before and outside range, and so found 58 observations on day four.

Based on 58 observations on day four, non productive activity (p_4) is 0.2241 and productive activity (q_4) is 0.7759. Given p, p_1, p_2 and p_3, mean of non productive activity until day four is ($\overline{p_4}$) 0.24905. Mean of productive activity until day four ($\overline{q_4}$) becomes 0.75095.

Including sample on day four, total of sample becomes 288 units. Observation frequency on day five is 23 units. Observation on last day (on Saturday), divisor is not used. This is due to time schedule services. Services only open during 150 minutes.

As consequences, all number bigger than 37 can't be included on observation. Having applied elimination and outside range, it's found that observation time for last day is 23 times.

Non productive activity proportion on day five (p_5) is 0.3478. Productive activity (q_5) on the other side is 0.6522. Given p, p_1, p_2, p_3, and p_4, mean of non productive activity until day five ($\overline{p_5}$) becomes 0.25694 and so mean of productive activity ($\overline{q_5}$) becomes 0.74306.

Work Sampling Using Self Report

Form provided for self report returned 13 exemplars. There is 275 data used as input to calculate non productive activity. Proportion of non productive activity ($\hat{p}_2$) is 0.18182 and proportion of productive during five days is 0.81818.

Based on calculation, accuracy level of questionnaires is 4.5585%. And so, significance level of 5% is fulfill.

Work Sampling Using Continuous Observation

Having recording operator activities during five days, saved in 6 video cassette 90 min, VCD produced. Activities are summarized using tally diagram. Activities recorded, first, transferred to VCD format. In order to write observation, VCD player playing slower four times than normal velocity.

It's found 1060 samples categorized as non productive activities on 60 time interval observation, whereas observation frequencies are 30 to 31, during 90 minutes. By summing allowance and unemployed of non productive activity until day five, it's found proportion of non productive activity until day five ($\hat{p}_3$) is 0.49939.

For interval confidence 95%, it shows that accuracy level (l) of continuous observation during five days is 1.03 %, and so significance level of 5% is fulfill.

The result is supported by sample quantity, i.e. sample minimum required with 95% confidence of interval for non productive activity are 385 samples.

Based on non productive activity observation above, non productive activity proportion using conventional method is 0.25694, self report is 0.18182, and continuous observation is 0.49939.

Testing of hypothesis in comparing non productive activity measured by each method is conducted using t-test. Hypothesis to be tested are:

1. There is no difference of non productive activity produced between conventional method and self report.
2. There is difference of non productive activity produced between conventional method and self report.

Test result shows that there is significant difference on non productive activity measured using conventional method and self report. Significance employed is 0.05. Based on non productive calculation above, it is logic to say that self report over in identify productive activity (0.25694 conventional method compare to 0.18182 self report)..

Comparing non productive activity measured by self report and continuous observation was conducted using t-test, with:

1. There is no difference of non productive activity measured between self report and continuous observation.

2. There is difference of non productive activity measured between self report and continuous observation.

Significance test employed is 0.05. Hypothesis test showed the rejection oh null hypothesis, means there is difference of non productive activity measured between self report and continuous observation. Non productive activity measured using continuous observation is 0.50061. It means that self report method over judge to report their activities.

It's still need to compare non productive activity measured using conventional and continuous observation methods. Hypothesis testing is:

1. There is no difference of non productive activity measured between conventional and continuous observation methods.
2. There is difference of non productive activity measured between conventional and continuous observation methods.

Result showed the rejection of null hypothesis and acceptance of alternative hypothesis. And so we can say there is significance different on non productive activity measured using conventional and continuous observation methods.

Non productive activity measured using the three methods is different each other. Self report method result in smaller of non productive activity proportion, followed by conventional methods. There is possibility un-honesty in using self report method, because worker asked to report their daily activity. The result showed by continuous observation method is close to reality, because worker was observed using non stop handy cam. The reliability of data provided using continuous observation then is higher than the two methods.

CONCLUSION

There are significant differences on non productive activity measured using conventional, self report, and continuous observation methods. Based on non productive activity calculation, self report method measured smaller non productive activity than two others methods. Continuous observation method measured non productive activity smallest among the three methods.

Non productive activity proportion of self report is 0.18182, conventional method as much as 0.25694, and continuous observation method is 0.49939.

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