Data Article

Dataset on Investigating the role of onsite learning in the optimisation of craft gang's productivity in the construction industry

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ABSTRACT

The data presented in this article is an original data on “Investigating the role of onsite learning in the optimisation of craft gang’s productivity in the construction industry”. This article describes the constraints influencing craft gang’s productivity and the influence of onsite learning on the blockwork craft gang’s productivity. It also presented the method of data collection, using a semi-structured interview and an observation method to collect data from construction organisations. We provided statistics on the top most important constraints affecting the craft gang’s productivity using 3-D Bar charts. In addition, we computed the correlation coefficients and the regression model on the influence of onsite learning on craft gang’s productivity using the man-hour as the dependent variable. The relationship between blockwork inputs and cycle numbers was determined at 5% significance level. Finally, we presented data information on the application of the learning curve theory using the unit straight-line model equations and computed the learning rate of the observed craft gang’s blockwork repetitive work.

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Specifications Table

| Subject area                                                                 | Economics, Construction Management, Project management, Management, Quantity surveying and Civil Engineering. |
|------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| More specific subject area                                                   | Construction Project Management                                                                             |
| Type of data                                                                 | Table, Figures.                                                                                              |
| How data was acquired                                                         | Data was acquired by conducting a Semi-structure Interview and observation of the craft gang's in the observed project site. |
| Data format                                                                  | Raw, filtered, analyzed.                                                                                     |
| Experimental factors                                                         | We make use of interview and observational data. Our sample was through purposeful.                          |
| Experimental features                                                        | Data on interview transcript, observed craft gang’s man-hour labour productivity.                           |
| Data source location                                                          | Nigeria.                                                                                                     |
| Data accessibility                                                            | The data are available with this article.                                                                    |
| Related research article                                                      | The data is not related to a companion paper to any research article.                                        |

Value of the data

- The presented data in Figs. 1–3 on the project-specific constraints influencing blockwork craft gang’s productivity could inform further research on constraints influencing craft gang’s productivity.
- Craft gangs learning rate productivity determine in Table 3 and Fig. 4 can stimulate further research on craft gang’s productivity using U-block, solid walls and curve walls.
- The data on Fig. 4 and Table 3 are further evidence on the application of the learning curve theory to blockwork craft gang’s.
- The data in this article could be useful to optimise further onsite craft gang’s productivity within a project specific environment.

1. Data

In this article, first we presented three 3-D bar charts representing the top constraints influencing onsite craft gang’s productivity (Figs. 1–3). The correlation coefficient table and the overall regression model between the productive input and its associated cycle number in Tables 1 and 2 was computed using simple linear regression technique. Table 3 present the learning rate of the observed repetitive work activity in the project.

Secondly, the data set presented in Tables 1–3 and Fig. 4 was derived from the observation study. A standard observation sheet and a stopwatch was used in recording the observed time for the craft gang's block laying operation in a working day. The data were collected daily to determine the variation in output for a total number of Twenty-six (26) observations from 7:00 a.m. to 6:00 p.m. daily.

2. Experimental design, materials and methods

The experimental data collection strategies used in this study is standard observation method and semi-structure Interviews.
2.1. Constraints influencing blockwork craft gangs productivity

The data presented in the interview were analysed via content analysis. Computer-assisted content analysis via NVivo 11 pro software was also used to aid the analysis. The participants interviewed were allocated a distinctive set of numbers. The reason for this numbers was for data coding system in order to determine the participant interviewed in the project in the analysis phase of the research. The number begins with the participant given as P, followed by the participant assigned number. For instance, if a participant is allocated with number P01, it means that P is the participant interviewed and was given the number 01.

The experimental design data on the project-specific constraints present the constraint with the highest response and rank. Fig. 1 shows the human/ motivation top project-specific constraints the craft gang’s needed to respond to, in order to optimise their productivity.

Fig. 2 shows the top Project management constraints the craft gangs needed to respond to, in order to optimise their productivity.

**Human/Motivation Constraints**

| Constraint                      | Responses | % of Responses | Rank |
|---------------------------------|-----------|----------------|------|
| Lack of Promotion               | 80        | 12             | 1    |
| Lack of Place of eating/Lunch break | 73      | 11             | 2    |
| Increase in Age of craft worker | 73        | 11             | 2    |
| Delay Payment                   | 73        | 10             | 4    |
| Attendance to social functions  | 67        | 10             | 4    |

*Fig. 1. Top 5 human/motivation constraints.*

**Project Management Constraints**

| Constraint            | Responses | % of Responses | Rank |
|-----------------------|-----------|----------------|------|
| Delay in material availability | 73      | 11             | 1    |
| Construction method   | 67        | 10             | 2    |
| Confined Space        | 53        | 8              | 3    |
| Specification and standards | 53      | 8              | 3    |
| Inspection delay      | 47        | 7              | 4    |

*Fig. 2. Top 5 project management constraints.*
Fig. 3 shows the top environmental, health and safety constraints the craft gang’s needed to respond to, in order to optimise their productivity.

2.2. Influence of onsite learning on blockwork craft gang’s productivity

Table 1 shows the data on regression correlation coefficients between blockwork inputs and cycle numbers at 5% significance level. The significance of the correlation coefficients was to determine the relationship between the data and the linear regression model. The coefficients were determined by substituting the linear regression model equation:

\[ Y = \alpha + \beta X \]  \hfill (1)

The regression equation, \( \alpha \) and \( \beta \) indicates the intercept and the slope of the linear regression model. The slope and the intercept are estimated thus;

\[ \beta = \frac{n\sum xy - \sum x \sum y}{n\sum x^2 - (\sum x)^2} \]  \hfill (2)

\[ \alpha = \bar{Y} - \beta X \]  \hfill (3)

where \( Y \) is the man-hours and \( X \) is the Cycle Numbers.
Table 1
Regression correlation coefficient for blockwork craft gang's.

| S/N | LN Man-hours | LN Cycle No | C   | D   | E   | F   | G   | H   | I   | J   | K   | L   | M   | N   | O   | P   | Y   |
|-----|--------------|-------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|     | X            | XY          | X²  | Y²  | nΣXY| ΣXΣY| nΣX²| (Σx)²| nΣY²| (ΣY)²| H-I | J-K | (L*M)¹/² | F-G | Y = O/N |
| 1   | 6.10         | -           | 0   | -   | 37.2100 | 9579.295908 9591.644112 4209.966516 3754.35602 | 24,505.59 | 24504.7716 455.6104957 0.82 19.28154985 -12.348204 -0.640415532 |
| 2   | 6.04         | 0.6931      | 4.18632 | 0.4804 | 36.4816 | 156.5 | 61.2728 | 368.434 | 161.9218 | 942.5226 |

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Table 2
Regression Model for Blockwork Craft gang’s.

| S/N | LN Man-hours | LN Cycle No | C | D | E | F | G | H | I (Σx)^2 | J | K | M | N | O |
|-----|--------------|-------------|---|---|---|---|---|---|----------|---|---|---|---|---|
| 1   | 6.10         | -           | 0 | - | - | - | - | - | 37.2100  | - | - | - | - | - |
| 2   | 6.04         | 0.6931      | 4.186324 | 0.4804 | 36.4816 |
| 3   | 6.03         | 1.1098      | 6.692094 | 1.2317 | 36.3609 |
| 4   | 6.01         | 1.3862      | 8.331062 | 1.9216 | 36.1201 |
| 5   | 6.01         | 1.6094      | 9.672494 | 2.5902 | 36.1201 |
| 6   | 6.03         | 1.7917      | 10.80395 | 3.2102 | 36.3609 |
| 7   | 6.12         | 1.9459      | 11.90891 | 3.7865 | 37.4544 |
| 8   | 6.04         | 2.0794      | 12.55958 | 4.3239 | 36.4816 |
| 9   | 6.05         | 2.1972      | 13.29306 | 4.8277 | 36.6025 |
| 10  | 6.02         | 2.3025      | 13.86105 | 5.3015 | 36.2404 |
| 11  | 6.04         | 2.3978      | 14.48271 | 5.7494 | 36.4816 |
| 12  | 6.03         | 2.4849      | 14.98395 | 6.1747 | 36.3609 |
| 13  | 6.04         | 2.5649      | 15.492   | 6.5787 | 36.4816 |
| 14  | 6.04         | 2.6390      | 15.93956 | 6.9643 | 36.4816 |
| 15  | 6.00         | 2.7080      | 16.248   | 7.3333 | 36.0000 |
| 16  | 6.01         | 2.7725      | 16.66273 | 7.6868 | 36.1201 |
| 17  | 6.04         | 2.8332      | 17.11253 | 8.0270 | 36.4816 |
| 18  | 5.98         | 2.8903      | 17.28399 | 8.3538 | 35.7604 |
| 19  | 6.01         | 2.9444      | 17.69584 | 8.6695 | 36.1201 |
| 20  | 5.98         | 2.9957      | 17.91429 | 8.9742 | 35.7604 |
| 21  | 5.98         | 3.0445      | 18.20611 | 9.2690 | 35.7604 |
| 22  | 5.99         | 3.0918      | 18.51988 | 9.5592 | 35.8801 |
| 23  | 5.98         | 3.1355      | 18.75029 | 9.8314 | 35.7604 |
| 24  | 5.98         | 3.1781      | 19.00504 | 10.1003 | 35.7604 |
| 25  | 6.01         | 3.2189      | 19.34559 | 10.3613 | 36.1201 |
| 26  | 5.98         | 3.2581      | 19.48344 | 10.6152 | 35.7604 |

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Table 3
Learning Rate for Blockwork Craft gangs Productivity.

| S/N | LN Man-hours | LN Cycle No | C | D | E | F | G | H | I | J | K | L | M | O | P | Q |
|-----|-------------|-------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|     | Y           | X           | XY | X2 | ∑XY | ∑XY | n∑X2 | (X)^2 | E-F | G-H | Y | X | Bx | α = Y-Bx | β = I/J | Y | X |
| 1   | 6.1000      | -           | -  | -  | 9.579.2959 | 9.591.6441 | 4.209.9665 | 3.754.3560 | -12.3482 | 455.6105 | -0.0271 | 6.0208 | 2.3566 | -0.0639 | 6.0846 |
| 2   | 6.0400      | 0.6931      | 4.1863 | 0.4804 |
| 3   | 6.0300      | 1.0998      | 6.6921 | 1.2317 |
| 4   | 6.0100      | 1.3862      | 8.3311 | 1.9216 |
| 5   | 6.0100      | 1.6094      | 9.6725 | 2.5902 |
| 6   | 6.0300      | 1.7917      | 10.8040 | 3.2102 |
| 7   | 6.1200      | 1.9459      | 11.9089 | 3.7865 |
| 8   | 6.0400      | 2.0794      | 12.5596 | 4.3239 |
| 9   | 6.0500      | 2.1972      | 13.2931 | 4.8277 |
| 10  | 6.0200      | 2.3025      | 13.8611 | 5.3015 |
| 11  | 6.0400      | 2.3978      | 14.4827 | 5.7494 |
| 12  | 6.0300      | 2.4849      | 14.9839 | 6.1747 |
| 13  | 6.0400      | 2.5649      | 15.4920 | 6.5787 |
| 14  | 6.0400      | 2.6390      | 15.9396 | 6.9643 |
| 15  | 6.0000      | 2.7080      | 16.2480 | 7.3333 |
| 16  | 6.0100      | 2.7725      | 16.6627 | 7.6868 |
| 17  | 6.0400      | 2.8332      | 17.1125 | 8.0270 |
| 18  | 5.9800      | 2.8903      | 17.2840 | 8.3538 |
| 19  | 6.0100      | 2.9444      | 17.6958 | 8.6695 |
| 20  | 5.9800      | 2.9957      | 17.9143 | 8.9742 |
| 21  | 5.9800      | 3.0445      | 18.2061 | 9.2690 |
| 22  | 5.9900      | 3.0918      | 18.5199 | 9.5592 |
| 23  | 5.9800      | 3.1355      | 18.7503 | 9.8314 |
| 24  | 5.9800      | 3.1781      | 19.0050 | 10.1003 |
| 25  | 6.0100      | 3.2189      | 19.3456 | 10.3613 |
| 26  | 5.9800      | 3.2581      | 19.4834 | 10.6152 |
| Σ   | 156.5400    | 61.2728     | 368.4345 | 161.9218 |

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In Table 2, \( \alpha = 6.08, \beta = -0.03, \gamma = -0.64 \) as presented in Table 1. Where \( \alpha \) is the intercept given by the standard linear equation, \( \beta \) is the slope of the linear curve, \( \gamma \) is the correlation coefficient of the observed gangs. Hence, the general regression model for the observed blockwork craft gang’s is given below as:

\[
Y = 6.08 - 0.03X
\]

That is, Man hours = 6.08 - 0.03 cycle numbers.

The unit straight-line learning curve model was used to determine the role onsite learning play in the blockwork craft gangs learning productivity. The straight-line unit model is expressed as a power function \([1-3]\). The mathematical expressions underlying the logarithmic straight-line learning curve are:

\[
Y = T_1\tilde{n}(x)^b
\]

where \( Y = \) cost, man-hours, or time required to perform the repeated unit; \( T_1 = \) cost, man-hours, or time necessary to perform the first unit; \( x = \) cycle number of the unit; and \( b \) represents the slope of the logarithmic curve, which is calculated as:

\[
b = \frac{\ln S}{\ln 2}
\]

where \( S = \) learning rate, which is defined as the percentage reduction in the unit input, i.e., cost, man-hours, or time, as a result of doubling the number of units completed. Eq. (5) can be rewritten as:

\[
S = (2^b) \times 100
\]

Fig. 4 and Table 3 presents data on the relationship between craft gang’s blockwork and the cycle numbers. We also presented the learning rate \( (S) \), expressed as a percentage, this was determined by substituting the slope \( (b) \), that is \(-0.06\), into the learning rate equation as follows: \( S = (2^{-0.03}) \times 100 \).

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Transparency document. Supplementary material

Transparency data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.dib.2017.09.073.

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