
Is formative homework a total waste of time? An empirical study

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Motivation for the study

In the 2012/13 academic year, I introduced my first year statistic students to weekly, formative, homework tasks. These tasks were designed to be completed online, allowing students to get immediate feedback on their work and get simple hints on where to investigate further if their answer was wrong. The main objectives of designing these tasks were :

- To allow students to apply what they were learning in lectures and tutorials
 - To develop regular study habits in students
 - To develop students' critical thinking skills
 - To further help students prepare for classes and tutorials
 - To make Statistics more accessible and 'fun'
- After a large scale experiment, I felt it was necessary to determine whether formative (non-compulsory) homework was effective in enhancing student learning or not.



The Issue

There is a vast literature in the pros and cons of homework...

- The debate is very old (since mid-1800s) and the research mostly comes from the US – Gill and Schlossman (2003) and Gill and Schlossman (2004)
- It is almost exclusively based on elementary and secondary school students (??)
- Topic of great controversy with the research to date being largely inconclusive - a number empirical studies claim to 'prove' both sides of the argument.
- Almost generalized agreement that “too much”, “too often” homework is harmful but little agreement on what ‘too much’ or ‘too often’ is.
- Significant national and cultural differences in the attitude towards homework appear to exist.



The Issue (II) – Key Lessons

Although not always clear, we can summarize some of the key findings of the research to date:

- The link between homework and student achievement is not clear; some studies show positive effects (e.g. Trautwein (2007); Keith, Diamond-Hallam and Fine (2004), etc) while others show no or negligible effects - e.g. see Cooper (1989) for a survey
- Homework seems to be more beneficial for older students – e.g. Cooper (1989), Hoover-Dempsey et al. (2001).
- Students from low-income homes do not benefit as much from homework as students from high-income homes (i.e. homework amplifies inequalities) – Ronning (2011)



The Issue (III) – Key Lessons (cont.)

- Homework might be beneficial in some subjects (Maths) but not others (Science, English, History) – Eren and Henderson (2011)
- Asian American students may benefit more from Homework than other ethnic groups in the US – Keith and Benson (1992)
- Of the (only) five (empirical) existing economic studies that examine the effects of homework on student outcomes, four focus on the US (Aksoy and Link (2000), Betts (1997), Eren and Henderson (2008) and Eren and Handerson (2011) and one on Holland (Ronning (2011)). All focus on high school students.
- This papers attempts to add to the existing literature by developing an empirical study on the effects of (formative) homework on student outcomes in a group of students taking a introductory statistics class in a university context.



Data

Data for this study:

- All students taking BEE1022 – Introduction to Statistics in 2012/13 (524 students)
- Students had to complete a total of 15 homework tasks over 11 weeks (VLE system). Tasks were mostly MCQs, most of which involved calculations before answering.
- Homework was formative (non-compulsory) and as such did not count towards final grade
- Students have the same lecturer and tutor so no need to control for unobserved teacher characteristics



Data: Example of homework task

Home > BEE1022 > Week 4 (15-21 October 2012) > Ch07 - Practice Questions > Preview

Quiz Navigation



Finish attempt ...

Start a new preview

Settings

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Question 1

Incorrect

Marked out of 1.00

Edit question

Suppose samples of size 49 are drawn randomly from a population of size 500 and the population has a mean of 300 and a standard deviation of 35, what are the values of the mean and the standard deviation of the distribution of the sample means?

Select one:

- a. 49 and 3.7534
- b. 300 and 4.7534
- c. 300 and 7
- See section 7.2 Sampling distribution of \bar{x} .
- d. 300 and 5
- e. 300 and 49

Check

Question 2

Correct

Marked out of 1.00

Edit question

Judgment sampling is an example of random sampling for handing judicial cases.

Select one:

- True
- False

Check



Data: Raw data

Variable	obs	Mean	Std. Dev.	Min	Max
id	0				
BA_AccFin	524	.2996183	.4585285	0	1
BA_BusEcon	524	.0896947	.2860169	0	1
BA_Econ	524	.3187023	.4664186	0	1
BA_EcFin	524	.1450382	.3524758	0	1
BA_ECEcon	524	.0152672	.1227307	0	1
BSC_ACC	524	.0763359	.2657885	0	1
BA_BUSACC	524	.0171756	.1300494	0	1
OTHER_BA	524	.0381679	.1917846	0	1
GRADE	512	53.86895	16.64245	9.5	92.5
England	524	.5343511	.4992953	0	1
China	524	.1278626	.3342558	0	1
France	524	.0171756	.1300494	0	1
HongKong	524	.0667939	.2499033	0	1
Indonesia	524	.0114504	.1064937	0	1
Malaysia	524	.0343511	.1823035	0	1
Singapore	524	.0152672	.1227307	0	1
Switzerland	524	.0114504	.1064937	0	1
Vietnam	524	.0152672	.1227307	0	1
wales	524	.0305344	.1722167	0	1
MATHS_A_LVL	508	.8248031	.3805101	0	1
ECON_A_LVL	508	.6220472	.4853537	0	1
HOME_FEE	524	.6431298	.4795338	0	1
Age	524	19.03244	1.801024	17	49
GENDER	524	.4312977	.4957308	0	1
SUM_HW	524	4.490458	4.531798	0	15

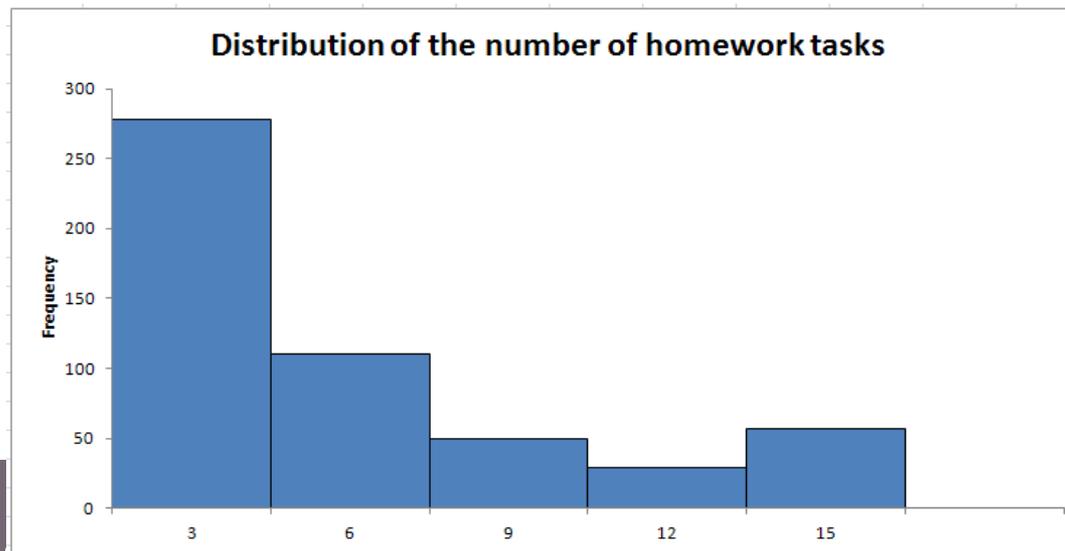


Data: Raw data

Average number of Homework tasks completed

Variable	Yes	No	Significant at 5% level?
English Student	4.957143	3.954918	Yes (p-value: 0.0011)
Female Student	4.668142	4.355705	No (p-value: 0.439)
Maths A Level	4.431981	4.595506	No (p-value: 0.771)
Economics A Level	4.75	3.984375	No (p-value 0.064)

p-value from a simple 2-sample t test



Empirical methodology

We assume that the impact of homework on the exam score (ES) of pupil i can be explained by the following simple education production function:

$$ES_i = \beta HW_i + \delta x_i' + \varepsilon_i$$

Where:

- ES_i = Final Exam Score for student i
- HW_i = number of homework tasks completed by student i
- x_i' = is a vector of observed student traits (including Nationality, Age, Gender, degree, whether student has A-level in Maths and/or Economics)
- ε_i = zero mean, normally distributed error term.



Results

VARIABLES	(1) Reg1 GRADE	(2) Reg2 GRADE	(3) Reg3 GRADE	(4) Reg4 GRADE	(5) Reg5 GRADE
Homework	0.9240*** (0.1580)	0.8983*** (0.1584)	0.8735*** (0.1597)	0.8792*** (0.1605)	0.8727*** (0.1673)
Age		-0.7957*** (0.2912)	-0.6701** (0.3146)	-0.7579** (0.2968)	-0.8603*** (0.3071)
MATHS_A_LVL		5.5267*** (1.9787)	4.7229** (2.0585)	4.3432** (2.0428)	4.2663** (2.1399)
ECON_A_LVL			2.7236* (1.5734)	3.1200* (1.6001)	1.9956 (1.9244)
Constant	49.6949*** (1.0462)	60.5793*** (6.1749)	57.2635*** (6.6955)	59.3839*** (6.3344)	58.0986*** (7.7103)
Observations	512	497	497	497	497
R-squared	0.063	0.086	0.091	0.107	0.118
RMSE	16.12	15.93	15.90	15.81	15.95
LogLikelihood	-2149	-2079	-2077	-2073	-2070

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

where (1) to (5) are OLS equations that include a varying number of independent variables, from the simplest in (1) (no control variables) to the most complete in (5) which includes 21 control variables were included.

Final Remarks

This paper is still work in progress. The main result is that it shows that completing online formative homework tasks contributes to higher grades even after controlling for student characteristics.

- Possible avenues for further research include:
 - To add a number of control variables to account for student characteristics (socio-economic status, study patterns, etc)
 - Include different measure of homework (e.g. effort)
 - Expand the study to other countries and compare results

