

## Final Project Report: Nexus Learning Grant, 2015-16

Project Title: Implementing Best Practices for Technology-Assisted Peer Review in a Capstone Course

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### **I. Introduction**

The goal of this project was to examine whether technology-assisted peer review enhanced active learning and student performance in more traditional classroom settings. Our use of technology for peer reviews was intended to overcome some of the hurdles currently faced in the peer review process that limited the effectiveness of student peer reviews. The following three items formed our specific learning outcomes:

- Discover how a change in the peer-review process to a technology-assisted one can impact and improve student performance (feedback and learning) on non-major, globally-oriented assignments.
- Understand how anonymity in the review process (double-blind) impacts the nature and quality of student feedback and learning.
- Find new and innovative ways to model, track, and assess students' peer review work, in light of the limited success of traditional methods of peer review, especially those used in writing classes. Specifically, determine whether technology-supported peer review increases the students' involvement, depth of comments, and seriousness of critique.

The technology that we used was Google Docs, an online software tool that allowed users to collaborate with peers and review each other's documents online. We wished to examine whether this pedagogical tool would serve the needs of a traditional classroom setting in the liberal arts by employing a more technologically versatile and student-friendly tool for peer reviews. Our additional goal was to examine whether anonymity in peer review would impact student performance, through better student feedback.

The project was carried out during the fall 2015 and spring 2016 semesters in three sections of the general education capstone seminars, Contemporary Perspectives, taught by Raju Parakkal. The analyses include data sourced from these three classes and from the Contemporary Perspectives class taught by Raju Parakkal in summer 2015. Our findings are based on both quantitative and qualitative analyses and direct and indirect assessments.

In the rest of this report, we first present the results from our quantitative analyses (linear regressions). We then discuss the results of the qualitative analyses (content analysis of student

surveys). We conclude by presenting the consolidated findings and implications of this study. We also note some of the limitations of this study in the concluding section. An appendix provides technical details of the variables used and detailed regression outputs.

## II. Quantitative Analyses and Findings

In this section we present the questions that motivated our research and the findings of our regression analyses. See table 1 below for both the questions and the findings. For the exact regression outputs, see the appendix. The appendix also contains details of the statistical measures and procedures that we employed.

**Table 1:** Research Questions and Findings

No.	Research Question	Finding
1.	Does peer review of student papers affect student performance on capstone papers?	Yes, but in a <i>negative</i> way. The results show that the score drops by a statistically significant 3 points for a peer-reviewed paper, even after controlling for other influential factors.
2.	Does the use of technology for peer-review of student papers affect student performance on capstone papers?	Yes, in a <i>positive</i> way. The results show that the score <u>goes up</u> by a statistically significant 6 points when technology in the form of Blackboard or Google Docs is used for peer reviews, as opposed to paper peer reviews. In this context, we analyzed the effects on student performance of (a) electronic peer review versus no peer review and (b) paper peer review versus no peer review. For (a), we found no evidence of a statistically significant effect in either direction. For (b), the results show that the score <u>goes down</u> by a statistically significant 8 points when the peer review is done in a traditional manner using paper. The collective finding is that peer review had a positive impact on student performance if it was conducted on a technology platform (Blackboard or Google Docs) and a negative effect if it was done via paper.
3.	Does the use of Google Docs for peer-review of student papers affect student performance on capstone papers?	There is <i>no evidence</i> of a statistically significant effect in either direction.

4.	Does anonymity of the peer-reviewing process affect student performance on capstone papers?	There is <i>no evidence</i> of a statistically significant effect in either direction.
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Note 1: We measured student performance by the total score (out of 100) obtained by a student on the paper.

Note 2: Three peer reviewing platforms were used – paper, Blackboard, and Google Docs.

Note 3: The data includes peer reviews done using hardcopies of student papers.

Note 4: All findings are reported for statistical models that were controlled for the following effects: assignment order, student’s GPA at the beginning of the semester, and student’s grades for Writing I and Writing II courses.

### III. Content Analyses of Student Surveys

Student feedback was both specific to the variables they experienced through the study’s peer review process as well as reflective of broader benefits of and concerns about peer review as a general practice. The differences in participant feedback highlighted variations in students’ individual learning styles which must be taken into account. However, they also suggested ways to modify and combine the peer review practices for maximum benefit for the students. A high frequency of students could articulate the value of anonymous peer review in the writing process. From their feedback we can discern best practices as well as potential student learning outcomes.

The majority of students expressed preference for either Google Docs or Microsoft Word via the class Blackboard site because they found online editing made it easier to edit as both reviewer and writer, easier to read and write comments, and/or more convenient to incorporate in later drafts. A minority of students were more comfortable with hard copies because they preferred to write by hand or read on paper. A moderate frequency of students expressed preference for conducting the review as an in class exercise, despite the fact that technology can allow for out of class applicability. A few students commented on the use of end and margin comments for feedback. The mixed feedback on these two components suggests that the perception of these two types of comments was shaped by personal preference rather than their applicability. The most frequently noted issues were technical difficulties and classmates who did not use the technology properly, both of which took time away from the activity. Making peer review a regular and clearly structured in-class activity would address such a learning curve and allow students to develop proficiency with both the technology and the process of providing a variety of feedback.

A majority of students articulated the value of anonymous feedback. A high frequency of students noted that anonymity allowed for honest and direct feedback with a different perspective. Students also frequently felt that anonymity eliminated embarrassment and pressure in the peer review process. A high frequency of students noted that anonymity improved feedback and a moderate frequency of students stated that they would use it to improve their assignments. Such comments demonstrate that students were actively reflecting on the peer review process through their participation in the project.

A low frequency of students disliked anonymous feedback when they weren't able to follow up with their peer for clarification. A low frequency found anonymity unnecessary. The majority of students who had a meeting with their reviewers found such a meeting to be helpful. The main reason cited was the ability to clarify the written comments. The feedback suggests that an initial anonymous review followed by a face to face discussion would combine the strengths of both approaches.

Besides the technological difficulties of learning a new process, students' most common dissatisfaction was that some of their peers did not provide enough substantive feedback. Students suggested that accountability for review with instructor feedback, additional reviewers, or a completed rubric by the reviewer could address this issue. These suggestions are all best practices in peer review exercises and possible ways to enhance the learning activity.

#### **IV. Conclusions**

On the basis of the findings from both the quantitative and qualitative analyses, we make the following conclusions and suggestions:

1. The peer-reviewing process is an effective means to improve student performance on papers, but only if undertaken electronically. Peer-reviewing using hardcopies of student papers results in a negative student performance on papers.
2. Google Docs can be an effective electronic means of peer-reviewing, provided the technological hiccups associated with both the software and learning to use the software are eliminated or drastically minimized.
3. Anonymity while peer-reviewing is a positive contributor to student performance and to the students' overall peer-reviewing experience. But once the reviewing has been completed, the anonymity must cease and the reviewer and reviewee must be allowed to discuss the review in person.

4. Overall, the peer-reviewing process shows a marginal drop in student performance when compared to papers submitted for instructor grading that were not peer-reviewed. We suspect this, rather unexpected, finding to be the substantially negative effect from peer reviewing on hardcopies of student papers.

5. Students must be sufficiently trained in the peer-review process, both in the technological and pedagogical mechanics of the process, so that the exercise will be beneficial to the reviewer and the reviewee.

6. Students should be provided appropriate incentives and motivation to undertake the review. And the peer-reviewing environment in the classroom must be made as relaxed and congenial as possible. A high pressure environment will not be conducive to producing mutually helpful reviews.

## Appendix: Technical Details and Regression Outputs

### I. Measures and Variables Used

Variable	Abbreviation*	Description of Variable and Measurement
Student Performance	<i>score</i>	The score (out of 100) the paper received after instructor review and grading.
Group	<i>group</i>	Dummy variable. Whether the paper was peer reviewed or not (0=not reviewed; 1=reviewed).
Electronic versus Paper Review	<i>evsp</i>	Dummy variable. Whether the review was on paper or electronic (0=paper; 1=electronic).
Electronic versus No Review	<i>evsnr</i>	Dummy variable. Whether an electronic review was done or not (0=no review; 1=electronic).
Paper versus No Review	<i>pvsnr</i>	Dummy variable. Whether a paper review was done or not (0=no review; 1=paper).
Google Docs	<i>gdvsngd</i>	Dummy variable. Whether the review was done using Google Docs or not (0=Paper or Blackboard; 1=Google Docs).
Anonymous Review	<i>anonymity</i>	Dummy variable. Whether the review was anonymous or not (0=not anonymous; 1=anonymous).
Assignment	<i>assignment</i>	Dummy variable. The order in which the particular assignment was completed during the semester. This variable controls for any effects of learning that occurs during the course of the semester w.r.t. the expectations and completion of paper assignments. (0=Assignment#1; 1=Section1; 2=Section2; 3=Section3).
Entering GPA <sup>#</sup>	<i>gpa</i>	The student's GPA at the beginning of the semester.
Writing I Grade <sup>#</sup>	<i>wrtgigrade</i>	The grade the student received in Writing I seminar. This information was missing for some students who had transfer credits for the Writing I seminar.
Writing II Grade <sup>#</sup>	<i>wrtgiigrade</i>	The grade the student received in Writing II seminar.

\* This abbreviation is used in the Stata regression outputs presented in this appendix.

<sup>#</sup> Data on GPA and Writing I and II grades were obtained exclusively for this research project from the Registrar's office.

Note: "Paper" here means hardcopy, as opposed to a softcopy or electronic version.

## II. Regression Outputs<sup>1</sup>

. regress score group

Source	SS	df	MS	Number of obs	=	363
Model	1191.93374	1	1191.93374	F(1, 361)	=	5.74
Residual	74971.7081	361	207.677862	Prob > F	=	0.0171
				R-squared	=	0.0156
				Adj R-squared	=	0.0129
Total	76163.6419	362	210.396801	Root MSE	=	14.411

  

score	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
group	-3.722742	1.553932	-2.40	0.017	-6.778637	-.6668462
_cons	82.62857	1.217955	67.84	0.000	80.23339	85.02375

. regress score group assignment gpa

Source	SS	df	MS	Number of obs	=	363
Model	17707.9073	3	5902.63577	F(3, 359)	=	36.25
Residual	58455.7346	359	162.829344	Prob > F	=	0.0000
				R-squared	=	0.2325
				Adj R-squared	=	0.2261
Total	76163.6419	362	210.396801	Root MSE	=	12.76

  

score	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
group	-2.66491	1.405731	-1.90	0.059	-5.429413	.0995916
assignment	1.017685	.612141	1.66	0.097	-.1861476	2.221518
gpa	18.19046	1.826195	9.96	0.000	14.59907	21.78184
_cons	18.89915	6.421062	2.94	0.003	6.271525	31.52677

<sup>1</sup> All regression analyses were conducted in *Stata* using the `regress` command.

. regress score group assignment gpa wrtgigrade wrtgiigrade

Source	SS	df	MS	Number of obs	=	287
Model	16588.7891	5	3317.75782	F(5, 281)	=	17.10
Residual	54511.643	281	193.991612	Prob > F	=	0.0000
				R-squared	=	0.2333
				Adj R-squared	=	0.2197
Total	71100.4321	286	248.602909	Root MSE	=	13.928

score	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
group	-3.266656	1.730659	-1.89	0.060	-6.673358	.1400448
assignment	.9452832	.753588	1.25	0.211	-.5381112	2.428678
gpa	19.642	2.952231	6.65	0.000	13.8307	25.45329
wrtgigrade	.7500106	1.367014	0.55	0.584	-1.940878	3.440899
wrtgiigrade	-.495114	1.54165	-0.32	0.748	-3.529763	2.539535
_cons	13.08979	8.05985	1.62	0.105	-2.77556	28.95513

. regress score evsp

Source	SS	df	MS	Number of obs	=	223
Model	2557.79203	1	2557.79203	F(1, 221)	=	9.22
Residual	61289.2304	221	277.326834	Prob > F	=	0.0027
				R-squared	=	0.0401
				Adj R-squared	=	0.0357
Total	63847.0224	222	287.5992	Root MSE	=	16.653

score	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
evsp	8.063725	2.655211	3.04	0.003	2.830951	13.2965
_cons	72.68627	2.331905	31.17	0.000	68.09066	77.28189

. regress score evsp assignment gpa

Source	SS	df	MS	Number of obs	=	223
Model	14577.6409	3	4859.21364	F(3, 219)	=	21.60
Residual	49269.3815	219	224.974345	Prob > F	=	0.0000
				R-squared	=	0.2283
				Adj R-squared	=	0.2178
Total	63847.0224	222	287.5992	Root MSE	=	14.999

score	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
evsp	4.411336	2.654274	1.66	0.098	-.8198544	9.642527
assignment	1.473872	1.05747	1.39	0.165	-.6102475	3.557992
gpa	20.05902	2.796268	7.17	0.000	14.54798	25.57006
_cons	5.927252	9.378914	0.63	0.528	-12.55723	24.41173

. regress score evsp assignment gpa wrtgigrade wrtgiigrade

Source	SS	df	MS	Number of obs	=	176
Model	14890.2808	5	2978.05615	F(5, 170)	=	11.06
Residual	45787.5147	170	269.338322	Prob > F	=	0.0000
				R-squared	=	0.2454
				Adj R-squared	=	0.2232
Total	60677.7955	175	346.73026	Root MSE	=	16.412

score	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
evsp	6.045651	3.416138	1.77	0.079	-.6978633	12.78916
assignment	1.535197	1.295412	1.19	0.238	-1.021967	4.092362
gpa	21.01773	4.494383	4.68	0.000	12.14574	29.88971
wrtgigrade	3.017337	2.090124	1.44	0.151	-1.108602	7.143276
wrtgiigrade	-1.756052	2.321675	-0.76	0.450	-6.339078	2.826974
_cons	-3.957264	11.85602	-0.33	0.739	-27.36125	19.44672

. regress score evsnr

Source	SS	df	MS	Number of obs	=	312
Model	272.368773	1	272.368773	F(1, 310)	=	2.42
Residual	34934.9357	310	112.693341	Prob > F	=	0.1211
				R-squared	=	0.0077
				Adj R-squared	=	0.0045
Total	35207.3045	311	113.206767	Root MSE	=	10.616

score	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
evsnr	-1.878571	1.208365	-1.55	0.121	-4.256206	.4990633
_cons	82.62857	.8971914	92.10	0.000	80.86322	84.39393

. regress score evsnr assignment gpa

Source	SS	df	MS	Number of obs	=	312
Model	11484.7434	3	3828.24781	F(3, 308)	=	49.70
Residual	23722.5611	308	77.0213022	Prob > F	=	0.0000
				R-squared	=	0.3262
				Adj R-squared	=	0.3196
Total	35207.3045	311	113.206767	Root MSE	=	8.7762

score	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
evsnr	-1.110692	1.044118	-1.06	0.288	-3.165198	.9438143
assignment	1.742069	.4563366	3.82	0.000	.8441373	2.640001
gpa	15.89368	1.4135	11.24	0.000	13.11234	18.67501
_cons	25.42281	4.896312	5.19	0.000	15.78835	35.05726

. regress score evsnr assignment gpa wrtgigrade wrtgiigrade

Source	SS	df	MS	Number of obs	=	251
Model	10281.032	5	2056.20641	F(5, 245)	=	24.31
Residual	20720.195	245	84.5722247	Prob > F	=	0.0000
				R-squared	=	0.3316
				Adj R-squared	=	0.3180
Total	31001.2271	250	124.004908	Root MSE	=	9.1963

score	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
evsnr	-1.492778	1.222146	-1.22	0.223	-3.900031	.9144743
assignment	1.770957	.5345751	3.31	0.001	.7180076	2.823906
gpa	16.17943	2.204329	7.34	0.000	11.83758	20.52129
wrtgigrade	.3029283	.9793881	0.31	0.757	-1.626166	2.232023
wrtgiigrade	.476597	1.109337	0.43	0.668	-1.708457	2.661651
_cons	21.60031	5.804463	3.72	0.000	10.16729	33.03332

. regress score pvsnr

Source	SS	df	MS	Number of obs	=	191
Model	3695.203	1	3695.203	F(1, 189)	=	14.37
Residual	48603.6661	189	257.162255	Prob > F	=	0.0002
				R-squared	=	0.0707
				Adj R-squared	=	0.0657
Total	52298.8691	190	275.257206	Root MSE	=	16.036

score	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
pvsnr	-9.942297	2.622836	-3.79	0.000	-15.11609	-4.768503
_cons	82.62857	1.355313	60.97	0.000	79.95509	85.30206

. regress score pvsnr assignment gpa

Source	SS	df	MS	Number of obs	=	191
Model	10601.0003	3	3533.66677	F(3, 187)	=	15.85
Residual	41697.8688	187	222.983256	Prob > F	=	0.0000
				R-squared	=	0.2027
				Adj R-squared	=	0.1899
Total	52298.8691	190	275.257206	Root MSE	=	14.933

score	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
pvsnr	-6.572532	2.542353	-2.59	0.010	-11.58791	-1.557153
assignment	.9016536	.971496	0.93	0.355	-1.014847	2.818154
gpa	16.02249	2.965473	5.40	0.000	10.17241	21.87257
_cons	26.48515	10.19175	2.60	0.010	6.379558	46.59073

. regress score pvsnr assignment gpa wrtgigrade wrtgiigrade

Source	SS	df	MS	Number of obs	=	147
Model	10159.4288	5	2031.88576	F(5, 141)	=	7.30
Residual	39249.2379	141	278.363389	Prob > F	=	0.0000
				R-squared	=	0.2056
				Adj R-squared	=	0.1775
Total	49408.6667	146	338.415525	Root MSE	=	16.684

  

score	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
pvsnr	-8.633844	3.396116	-2.54	0.012	-15.34773	-1.919954
assignment	.9012798	1.239011	0.73	0.468	-1.54816	3.35072
gpa	17.21022	4.937015	3.49	0.001	7.450084	26.97036
wrtgigrade	.0314248	2.225688	0.01	0.989	-4.368608	4.431457
wrtgiigrade	-.4568336	2.502282	-0.18	0.855	-5.403674	4.490007
_cons	23.83609	13.54925	1.76	0.081	-2.949851	50.62203

. regress score gdvsngd

Source	SS	df	MS	Number of obs	=	223
Model	284.53815	1	284.53815	F(1, 221)	=	0.99
Residual	63562.4843	221	287.613051	Prob > F	=	0.3210
				R-squared	=	0.0045
				Adj R-squared	=	-0.0000
Total	63847.0224	222	287.5992	Root MSE	=	16.959

  

score	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
gdvsngd	2.415839	2.428857	0.99	0.321	-2.370847	7.202525
_cons	78.12583	1.380117	56.61	0.000	75.40595	80.8457

. regress score gdvsngd assignment gpa

Source	SS	df	MS	Number of obs	=	223
Model	13959.9062	3	4653.30208	F(3, 219)	=	20.43
Residual	49887.1162	219	227.795051	Prob > F	=	0.0000
				R-squared	=	0.2186
				Adj R-squared	=	0.2079
Total	63847.0224	222	287.5992	Root MSE	=	15.093

  

score	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
gdvsngd	.2769834	2.179135	0.13	0.899	-4.017777	4.571743
assignment	.8605447	.9977923	0.86	0.389	-1.105959	2.827049
gpa	21.22221	2.739195	7.75	0.000	15.82365	26.62077
_cons	6.133235	9.449724	0.65	0.517	-12.4908	24.75727

. regress score gdvsngd assignment gpa wrtgigrade wrtgiigrade

Source	SS	df	MS	Number of obs	=	176
Model	14048.2227	5	2809.64454	F(5, 170)	=	10.24
Residual	46629.5728	170	274.291604	Prob > F	=	0.0000
				R-squared	=	0.2315
				Adj R-squared	=	0.2089
Total	60677.7955	175	346.73026	Root MSE	=	16.562

  

score	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
gdvsngd	.1951813	2.642115	0.07	0.941	-5.020398	5.410761
assignment	.8047026	1.239336	0.65	0.517	-1.641767	3.251172
gpa	23.06528	4.40316	5.24	0.000	14.37337	31.75719
wrtgigrade	2.641921	2.098349	1.26	0.210	-1.500255	6.784097
wrtgiigrade	-1.782845	2.346247	-0.76	0.448	-6.414375	2.848685
_cons	-3.738063	11.9667	-0.31	0.755	-27.36052	19.8844

. regress score anonymity

Source	SS	df	MS	Number of obs	=	223
Model	26.9892508	1	26.9892508	F(1, 221)	=	0.09
Residual	63820.0332	221	288.778431	Prob > F	=	0.7601
				R-squared	=	0.0004
				Adj R-squared	=	-0.0041
Total	63847.0224	222	287.5992	Root MSE	=	16.993

  

score	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
anonymity	-.6995122	2.288138	-0.31	0.760	-5.208875	3.809851
_cons	79.21951	1.532251	51.70	0.000	76.19982	82.2392

. regress score anonymity assignment gpa

Source	SS	df	MS	Number of obs	=	223
Model	14143.4918	3	4714.49727	F(3, 219)	=	20.77
Residual	49703.5306	219	226.956761	Prob > F	=	0.0000
				R-squared	=	0.2215
				Adj R-squared	=	0.2109
Total	63847.0224	222	287.5992	Root MSE	=	15.065

  

score	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
anonymity	-2.713527	2.987283	-0.91	0.365	-8.601029	3.173975
assignment	-.1030814	1.456697	-0.07	0.944	-2.974021	2.767859
gpa	21.42452	2.717725	7.88	0.000	16.06828	26.78077
_cons	8.036555	9.665026	0.83	0.407	-11.01181	27.08492

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. regress score anonymity assignment gpa wrtgigrade wrtgiigrade
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Source	SS	df	MS	Number of obs	=	176
Model	<b>14217.4228</b>	<b>5</b>	<b>2843.48456</b>	F(5, 170)	=	<b>10.40</b>
Residual	<b>46460.3727</b>	<b>170</b>	<b>273.29631</b>	Prob > F	=	<b>0.0000</b>
				R-squared	=	<b>0.2343</b>
Total	<b>60677.7955</b>	<b>175</b>	<b>346.73026</b>	Adj R-squared	=	<b>0.2118</b>
				Root MSE	=	<b>16.532</b>

score	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
anonymity	<b>-2.937391</b>	<b>3.71677</b>	<b>-0.79</b>	<b>0.430</b>	<b>-10.27436</b>	<b>4.399576</b>
assignment	<b>-.2357065</b>	<b>1.807226</b>	<b>-0.13</b>	<b>0.896</b>	<b>-3.803201</b>	<b>3.331788</b>
gpa	<b>23.36515</b>	<b>4.382125</b>	<b>5.33</b>	<b>0.000</b>	<b>14.71476</b>	<b>32.01554</b>
wrtgigrade	<b>2.444919</b>	<b>2.109262</b>	<b>1.16</b>	<b>0.248</b>	<b>-1.718799</b>	<b>6.608637</b>
wrtgiigrade	<b>-1.694125</b>	<b>2.341871</b>	<b>-0.72</b>	<b>0.470</b>	<b>-6.317017</b>	<b>2.928767</b>
_cons	<b>-1.606487</b>	<b>12.24831</b>	<b>-0.13</b>	<b>0.896</b>	<b>-25.78486</b>	<b>22.57189</b>