A Comparative Study between BHCC Dual Enrollment and MHS:

What is the difference in rigor between BHCC Dual Enrollment Psychology class and AP

Psychology taught class at MHS?

Abstract

High schools nationwide are seeking the most effective ways to prepare their students for college. There exist accelerated programs such as dual enrollment, virtual high school, advanced placement, and even external resources are available. The college preparatory programs that grant college credit share one objective, so transitively they should be equal in rigor. However, these trends have yet to be proven. Within the parameters of Malden High, there exist two college credit granting programs, BHCC Dual Enrollment and AP courses. BHCC Dual Enrollment courses are a collaboration between the local community college, Bunker Hill Community College, and Malden High School. AP Courses are offered as a class in school. What is the difference in rigor between BHCC Dual Enrollment Psychology class and AP Psychology taught class at MHS? There may exist disparities in rigor between the two courses, yet both grant college credit. To explore this loop in the credit system, between two different programs with the same goal, I conducted a study comparing the rigor of BHCC Psychology Dual Enrollment and AP Psychology. While this is a minor slice of the whole that each program offers, the contrasts and comparisons speak to the level of academic rigor. BHCC Professors, AP Psychology teachers, students, educators, legislators, and researchers are consulted and/or referenced in this qualitative-quantitative study. Past definitions of rigor selected from varying institutions, states and studies are reviewed. To evaluate the honesty of college credit at Malden High, this study attempts to create a measurement of rigor in order to explore the disparities between two college credit granting programs, BHCC Dual Enrollment and AP courses. The

findings of this research may influence future development of not only Malden High's credit

system, but the further development of a concrete measurement for rigor.

Introduction and Exigency

Students at Malden High School are offered the opportunity to enroll in Advanced Placement courses. Advanced Placement was constructed by College Board in the twentieth century, after World War II. Its main objective then was to avoid the overlap in secondary and college level education in order to enable students who pass designated achievement assessments to transition into higher education with "advanced standing." Thus a program with a balance of innovative, trained teachers and eager, high-achieving students was born ("Implications of Advanced Placement Programs", 2003).

Today, AP Courses have become integral to students that wish to flourish in academia. Students are scored on a scale of 1-5 in each subject. The auditing of assessments by the College Board has theoretically increased the rigor of AP, leading more and more colleges to accept AP Credit, which has more weight than Honors and CP credit, allowing students an academic and economic advantage in college ("How to Earn Credit For Your Scores", 2016).

Letter Grade	Numeric Grade Equivalent	Value Achievement Level		
		College Prep	Honors	Advanced Placement
A+	98-100	4.3	4.8	5.3
A	93-97	4.0	4.5	5.0
A-	90-92	3.7	4.2	4.7
B+	87-89	3.3	3.8	4.3
B	83-86	3.0	3.5	4.0
B-	80-82	2.7	3.2	3.7
C+	77-79	2.3	2.8	3.3
C	73-76	2.0	2.5	3.0
C-	70-72	1.7	2.2	2.7
D+	67-69	1.3	1.8	2.3
D	63-66	1.0	1.5	2.0
D-	60-62	.7	1.2	1.7
F	0-59	0	0	0

(Malden High School, 2016)

An alternative to taking an AP course, which could grant equivalent credit, is enrolling in courses at a local community college. Some people may argue that by participating in these academic programs outside of school, students are "taking it a step further" (U.S. News & World Report., 2008). The Obama Administration supported the community-college-hosted dual enrollment programs at high schools, "in other words, in the Obama Administration's view, college has become the new high school" (Vara, 2015). The purpose of Dual Enrollment programs has expanded higher education into high schools. Implicitly fulfilling the same objective as AP programs.

At Malden High School, a Dual Enrollment program is made possible by a partnership between Malden High School and Bunker Hill Community College ("Dual Enrollment", 2016). Our credit system allows for these courses to potentially yield AP Credit in certain courses such as AP Psychology, Statistics, Biology, and certain business courses.

AP courses in high school are also highly valued for the same purposes of awarding college credit and preparing students for college. College Board's Head of AP, Trevor Packer advocates for AP, "Because each AP Exam consists of questions developed by top-tier college professors, AP teachers use such questions to inspire students to work hard in developing the skills fundamental to college majors and careers - the ability to explain key concepts clearly and precisely, to solve real-world problems, and to use evidence from primary source documents to build an argument." Likewise, AP students also succeed in moving on to higher institutions, 33.2 % of public graduates in 2013 took an AP Exam, compared to 18.9% of graduates in the 2003 nationwide (The College Board, 2014).

Dual Enrollment Courses satiate high school students' hunger for knowledge and unique courses that are not offered at their level or institution. It guarantees college credit from a college, and exposes students to a college campus, catalyzing college recruitment. In addition, these courses are free, making them accessible to more demographics (Finn, 2017).

There's widespread belief that since Dual Enrollment programs are so rare, they are more valuable to colleges. Ankit Gandhi, who took 16 classes at the University of South Florida before graduating from a high school in Tampa, earnestly states, "Everyone takes AP classes, so you always have to do a little more to distinguish yourself." This "little more" Gandhi is referring to is dual enrollment. From Gandhi's perspective, dual enrollment is one step above an AP. Gandhi was admitted to 14 schools, including Duke and MIT (U.S. News & Report, 2008). On a larger scale, researchers believe dual enrollment course have more yield of students going on to flourish in higher education, for example, former dual enrollment students are more likely to take college courses and meet college standards later on (Research in Higher Education, 2013). Dual Enrollment receives extensive praise for producing college ready students.

At the core of Advanced Placement and Dual Enrollment program lies one shared intent: to give students the opportunity to be college ready. Transitively, this would imply that the courses should overlap somewhere. However, in actuality, this has yet to be affirmed.

AP instructors each have a sequence of steps to follow in order to become AP teachers. The College Board has a site outlining AP Course Audits. Specifically for AP Psychology, teachers must review preliminary resources such as a set course and exam description and then create a syllabus that will be approved by College Board. There are curriculum/resource

requirements set, examples, a development guide, and a syllabus checklist for teachers to use as resources in constructing an appropriate syllabus (College Board "Learning List," 2016).

Dual Enrollment, relative to AP courses, have a pauce scope in the world, this academic bridge having only been recently introduced to the sphere of education.

Measures have been taken to ensure the quality of dual enrollment courses, and studies have been conducted to evaluate as well as improve these courses. How do we know that these are real college courses? States such as Colorado, Florida, Idaho, Illinois, Kansas, Montana, Utah and Washington, have adopted National Alliance of Concurrent Enrollment Partnerships (NACEP) standards, which essentially set guidelines for dual enrollment. One of these, for example, include the rule that high school teachers must possess master's degrees or the equivalent in subjects they wish to teach dual enrollment (Zinth, 2015 & Finn, 2017).

Jennifer Dounay Zinth, director of the High School Policy Center and STEM Policy Center at the Education Commission of the States conducted a study that focused on specific mechanisms implemented by certain states to ensure quality of dual enrollment courses. Zinth believes it is essential that colleges ensure high school instructors teaching dual enrollment have a clear foundation in the curriculum and course components, and are equipped with the knowledge and skills necessary to deliver the content. She evaluated 4 state-installed approaches to provide evidence for efficacy (or lack of efficacy) of dual enrollment courses: local control, moderated local control, adopting NACEP standards, and allowing for accreditation of NACEP standards. Additionally, Zinth provides explanation for the effects of underqualified teachers teaching dual enrollment. She claims many instructors do not possess the master's level coursework or other qualifications necessary to lead dual enrollment courses (Zinth, 2015).

Contrary to the College Board, the Obama Administration, and other esteemed institution's beliefs, there has been observed a disparity in learning outcomes and experiences between these two programs. (Hebert, 2001). The effectiveness and individual experiences of each program varies from study to study and place to place.

A study comparing the learning outcomes for dual-enrollment mathematics students taught by high school teachers to students taught by college faculty in Florida was conducted. The researchers believe that there would be no difference in outcomes for dual enrollment students taught by high school teachers versus those taught by college faculty. The intent was to provide evidence upon which policy decisions concerning the transferability of dual enrollment credit could begin to be made. "What was demonstrated was that the learning outcomes produced by high school teachers were actually superior. Dual enrollment students taught by high school teachers were better prepared for subsequent coursework at the university level than were those taught by college faculty" (Hebert, 2001). But is this conclusion absolute? Is this true in Malden as well?

At Malden High School, there are students who take AP courses by day and Dual Enrollment by night. It is essential to investigate the efficacy and rigor of these courses, little research has been done to reveal any gaps. This uninvestigated gap in academic experience prods the question, is there a difference between BHCC Dual Enrollment classes and AP classes at MHS? In order to effectively prepare students for college, as well as maximize and qualify the rewarding of AP credit, it is necessary to the delineate the differences, shortcomings, and triumphs of AP courses and BHCC Dual Enrollment courses.

A concrete measurement of rigor will be created for the purposes of the study, which will be synthesized from past definitions and studies of rigor. An official definition and measurement of rigor does not exist. The educational sphere will benefit from the synthesis of many approaches of rigor into a singular measurement tool. While it is not expected to be omnipotent and entirely accurate, hopefully the shortcomings of my attempt to measure rigor raises awareness towards the need for one widely accepted system of measurement.

Review of Literature

Essentially, what we are trying to measure is rigor. Rigor is a component of the classroom, and its absence inhibits intellectual growth. Rigor has no set scale.

Rigor in the classroom has been divided into three subcategories: course content, instruction, and assessments by the SERVE Center of the University of North Carolina at Greensboro Edmunds defines rigor not as having more pages of classwork or homework and that redundancy as an inhibitor of rigor. Rigor is part of quality instruction, not vice versa.

Rigorous course content can be measured by the ability of students to meet state standards. In addition, according to Edmunds, basic skills in the course are coupled with key concepts in the curriculum, and these lessons can be applied to real-world problems (Appendix A).

Rigorous Instruction includes activities to engage students in higher order thinking. More in depth communication is encouraged.

Rigorous Assessments should align with these "higher order goals." When creating an assessment, there is a checklist to ask one-self:

- Is the assessment aligned to the lesson goals?

- Do students have to use higher order thinking skills on the assessment?

- Do students have to explain or justify their conclusions or thinking?

Through the evaluation of these three components of a rigorous classroom, more explicitly defined in methodology, the gap between AP Courses at Malden High and BHCC Dual Enrollment can be closed (Edmunds, 2016).

Other attempts to categorize rigor have not been as clear and empirical. A study at the Gardner-Webb University conducted a study assessing the impact of a Freshman Academy's approach on rigor, relevance and relationships in another classroom setting. The purpose of the study was to observe how implementing the curriculum, using teacher collaboration, and creating a Freshman Academy could impact the rigor, relevance, and relationships for both students and teachers during the ninth-grade year. In this study, rigor was mandated as part of the State of North Carolina policies for secondary schools. The definition for rigor in this study was borrowed from the North Carolina Department of Public Instruction NCDPI, deemed as "Non-negotiable." To them, rigor:

1. Has qualitatively different academic environments (More In-Depth, Complex and Abstract Concepts and Ideas)

2. Builds upon interests, strengths and personal goals

3. Engages students consistently in investigations of text, materials, technologies and activities

4. Employs advanced critical and creative processes

5. Welcomes teachers and students as risk-takers in all learning processes

6. Utilizes existing knowledge and creates knowledge

7. Develops and applies a deep understanding of concepts, generalizations, and essential questions to problem finding/solving

8. Sets no predetermined limits

9. Creates lifelong learners and thinkers capable of independent reflection, evaluation and reasoning

(Moose, 2015).

While Moose's findings and definition of rigor definitely overlap with Edmund's triangle, they differ in that Edmund has classified rigor into 3 spheres of the classroom and proceeded to organize similar expectations of rigor, mirrored by the NCDPI, into these 3 categories (Moose, 2015 & Edmunds, 2016).

Bloom's Taxonomy serves to help teachers form lessons that develop the skills of students. It has been reviewed several times, but the original objective remains the same: to categorize questions and activities according to levels of abstraction. It uses verbs that vary from taxonomy level to taxonomy level. The lowest taxonomic level is *remember,* moving on to *understand,* to *apply* and *analyze,* then eventually *evaluate* and *create.* These taxonomic levels are the revised Bloom Process Dimensions from 2005, differing from the original Bloom's Taxonomy, since teachers complained that "Not all of the questions residing at the same level of Bloom's Taxonomy offer my students the same mental challenge" (Appendix B).

Norman Webb's depth-of-knowledge model in the late 1990's prodded educators to re-define test alignment to include not only the course content, but the the depth to which students comprehend the content. Basically, the complexity of the content and the required task (Appendix B).

The study argued that, Bloom's Taxonomy, paired with Webb's Depth of Knowledge, provided a more clear measurement for rigor. Each had its shortcomings and differences: "Bloom's Taxonomy categorizes the cognitive skills required of the brain when faced with a new task, therefore describing the type of thinking processes necessary to answer a question. The DOK model, on the other hand, relates more closely to the depth of content understanding and scope of a learning activity, which manifests in the skills required to complete the task from inception to finale (e.g., planning, researching, drawing conclusions)" (Appendix B).

In 2006, Karin. K Hess combined the two to create the Cognitive Rigor Matrix (Hess, 2009).

In a study sponsored by the Center for Educational Effectiveness in 2007 that set out to synthesize the literature and existing rubrics or models relating to the basic practices of quality teaching and learning, Robert R. MacGregor created an Appendix A of the essential practices and attributes of high quality teaching and learning (MacGregor, 2007).

Many of the practices in MacGregor's Appendix A align with Edmund's expectations under the three categories of course content, assessments, and instruction (MacGregor, 2007 & Edmunds, 2016). In addition, there are many similarities between the components of a rigorous classroom in the guidelines set by the NCDPI (Moose, 2015). Overall, what can be taken from these studies and definitions of rigor is that a rigorous classroom entails that teachers encourage

students to engage in higher level thinking, identified by Bloom's Taxonomy and the Depth of

Knowledge model as when students create and think extensively (Hess, 2009).

Method

Dr. Reid Lyon, Chief of the Child Development and Behavior Branch at the National

Institute of Child Health and Human Development (NICHD) at the National Institutes of Health

(NIH), addressed the different approaches to educational research to the Committee of Education

in 2000.

Lyon believed that the type of research design most apt to answering a question of

whether a program, instruction, or approach is effective, is an experimental or

quasi-experimental approach. These studies are strictly quantitative.

But Lyon continues on to highlight the benefits of a qualitative research, which are more

exploratory, allowing for the formation of hypotheses. Descriptive, non-experimental research

helps researchers build theory, help new design instructional approaches and interventions, and

help understand the target or focus for an intervention. The findings of such qualitative studies

could lead to the development of more detailed quantitative studies.

Considering the potential data yields and shortcomings of each research approach, to

maximize the efficacy and relevance of my study on rigor, my research incorporated both

quantitative and qualitative approaches. Integrating research approaches in an effective and

appropriate way requires an understanding of the pros and cons underlying each research

method. There would be limitations for both types of research, but, as Lyon said, "The bottom

line is that studies that use both types of approaches are important and necessary if we are to

develop the fullest and richest understanding of what specific instructional approaches are most

effective for which children at which stage of development and under what particular

circumstances… (Lyon, 2000).

I started by collecting digital and paper work from the Malden High School AP

Psychology teacher and multiple Dual Enrollment PSY 101 Professors. Specifically, I looked

into Edmunds three components of rigor: content, assessments, and instruction.

It was necessary to grasp what made a course "rigorous." I had collected studies where

Bloom's Taxonomy was integrated with Webb's Depth of Knowledge Model (Hess, 2009),

where classroom rigor was integrated into three subcategories (Edmunds, 2016), and where the

North Carolina Department of Public Instruction's definition of rigor was used as a measurement

(Moose, 2015).

So, preceding the collecting of sufficient sources to grasp classroom "rigor," I attempted

to apply just Bloom's Taxonomy in order to be able to quantify and measure rigor. The purpose

of rigor, synthesized in each study above, is to lead students to a higher level of thinking. The

highest level in Bloom's Taxonomy model is "create" (Hess, 2009). There were verbs to help me

code my way through the data I had collected.

Revised Bloom Process Dimensions (2005)

Remember
Retrieve knowledge from long-term memory,
recognize, recall, locate, identify

Understand
Construct meaning, clarify, paraphrase, represent,
translate, illustrate, provide examples, classify,
categorize, summarize, generalize, infer a logical
conclusion (such as from examples given), predict,
match similar ideas, explain, compare/contrast,
construct models (e.g., cause-effect)

Apply
Carry out or use a procedure in a given situation;
carry out (apply to a familiar task) or use (apply)
to an unfamiliar task

Analyze
Break into constituent parts, determine how parts
relate, differentiate between relevant and
irrelevant, distinguish, focus, select, organize,
outline, find coherence, deconstruct (e.g., for bias
or point of view)

Evaluate
Judge based on criteria, check, detect
inconsistencies or fallacies, judge, critique

Create
Combine elements to form a coherent whole,
reorganize elements into new
patterns/structures, generate, hypothesize,
design, plan, construct, produce for a specific
purpose

(Hess, 2009)

The rationale behind why I determined to use Bloom's Taxonomy over Webb's Depth of Knowledge Model was empirical. Bloom's Taxonomy had specific identifying verbs under every level of learning, making it an effective tool of assessment, as opposed to the more subjective levels of learning in Webb's Depth of Knowledge.

Employing a method called "coding," I proceeded to evaluate the digital and/or paper syllabi, which I had received from Malden High and BHCCl. The purpose of coding is to make things easier to find, faster. Coding is classification, one can decide how to organize things through identification of themes, ideas, terms or keywords in the data. Types of things that can be coded include, behaviours, events, activities, strategies, states, meanings, participation, relationships, etc. Each have their own indicators. When you code a passage, you should compare it to ones you have coded before to see if they align in theme (Gibbs, 2005). I coded the syllabi and tests I received from the MHS and BHCC psychology classrooms, following the 6 levels of Bloom's.

Findings

Syllabi A and B are two different BHCC psychology classes. Syllabus C is the AP Psychology class at Malden High. I've created tables to display my findings. I searched for the mere presence of each level of thinking, indicated by verbs presented by Bloom's Taxonomy. These verbs were determined by the Revised Bloom Process Dimensions from 2005 (Hess, 2009). I've listed some verbs found in each document in the table.

		Syllabus A Indicative Verbs
Remember	✔	Provide, introduce, read, define...
Understand	✔	Discuss

Apply		
Analyze		
Evaluate		
Create	✔	Create (a final paper)

	Syllabus B Indicative Verbs	
Remember	✔	Read
Understand	✔	Explain
Apply	✔	Predict, discuss, intervene...
Analyze	✔	Analyze
Evaluate		
Create		

	Syllabus C Indicative Verbs	
Remember	✔	Introduce, study, read, define..
Understand	✔	Discuss, explain, identify, describe..
Apply	✔	Apply...
Analyze	✔	Differentiate, distinguish, compare...
Evaluate	✔	Evaluate...
Create	✔	Create, make…

For the questionnaires, if even one student answered "mostly" or "always" to the question

correlating with the level of learning, I interpreted it as a pass for that level. The students were

given a 1-5 Leichhardt scale to answer questions that correlated to each level of thinking

(Appendix C). Students answered 1 for "never," 2 for "rarely," 3 for "sometimes," 4 for "most of

the time," and 5 for "always." Data collected from Google Forms regarding all responses to each

of the 11 questions can be found in Appendix D.

BHCC Assessment Questionnaire

Q: 1-2	Remember	
Q: 3-4	Understand	
Q: 5-6	Apply	
Q: 7-8	Analyze	
Q: 9-10	Evaluate	
Q: 11	Create	

MHS AP Psychology Questionnaire

Q: 1-2	Remember	✔
Q: 3-4	Understand	✔
Q: 5-6	Apply	✔
Q: 7-8	Analyze	✔
Q: 9-10	Evaluate	✔
Q: 11	Create	✔

Analysis

Every verb in each syllabi was classified under each of the levels of learning in Bloom's. The presence of each verb was sufficient to prove the presence of the level of learning. I omitted frequency due to the difference in the overall class time each course received.

Syllabus A achieved the 5th and highest level of learning when it asked students to "create" a final paper. It also proved to have the lower level of learning. However, there is a hole in the 3rd, 4th and 5th levels of learning. This means that the teacher is asking the students to do higher level thinking while not necessarily guiding the students to that level of thinking.

Syllabus B exhibited verbs that proved the first four levels of Bloom's, but did not proceed to the last two levels. This means that this professor may be more consistent in guiding the students to higher level thinking, but does not truly lead them to the highest level.

Syllabus C achieved all the levels of Bloom's higher level thinking. While some verbs were more occurent than others, verbs demonstrating every level of thinking were exhibited.

It is important to note that Syllabus A and B were under 5 pages, with less verbs to classify. Syllabus C was well over 20 pages. Both courses could be traded in for college credit, presumably covering the same course material as an introductory college course on psychology.

As for the assessments, each question correlated with a level of learning in Bloom's. Questions 1 and 2 correlated with the first level of thinking, "remember." Questions 3 and 4 represented the "understand" level of thinking. "Apply" could be summed up into questions 5 and 6. Questions 7 and 8 evaluated whether or not students were asked to "analyze." Questions 9 and 10 revealed whether or not students were asked to demonstrate evaluation skills, correlating

with the fifth level of thinking. Finally question 11 asked whether or not students were asked to
"create" (Appendix C).

40 AP Psychology students at Malden High took the Psychology Assessment
Assessment. To reiterate, if students answered "mostly" or "always" (4 or 5), I interpreted those
responses as exhibiting that level of learning. At least one student answered "mostly" or
"always" to each question, which, within the parameters of this study and the rules of the
methodology, indicates that the assessments in AP Psychology are "rigorous."

Limitations

A revision I made to the application of Edmund's original three components of rigor in
the classroom was that I assessed by content and assessments but not instruction (Edmunds,
2016). To represent content, I collected syllabi. For assessments, I obtained tests. I chose to omit
instruction. MacGregor's study concluded that instruction and engagement are the most lacking
and unstable of all the practices of quality teaching and learning. Communities that develop are
often not communities engaged in instructional improvement. Most instruction, despite the best
intentions, is not effective. There is a lot of room for improvement in this area (MacGregor,
2007).This particular study will omit this component of the classroom, not because it is
irrelevant, but because it is too unstable to assess and yield accurate results. Therefore in the
application of Bloom's Taxonomy, Practices 2, 3, and 5 were not taken into consideration, and I
did not assess teacher instruction.

A complication that arose during the collection of data included an inability to obtain any
BHCC Psychology assessments. With the AP Psychology assessments in hand, I had to find a
way to obtain equivalent quantifiable data on BHCC Psychology. To substitute the assessments

from BHCC that were not accessible, I created a questionnaire that evaluated whether or not

students were asked to demonstrate the different levels of Bloom's higher level thinking

(Appendix C). This questionnaire was created and distributed on Google Forms, following the

Leichhardt Scale.

Some considerations include the instructional hours of each course. BHCC Dual

Enrollment courses met only once a week from 6:00 PM to 8:45 PM, for one semester. Malden

High's AP Psychology class 4-5 days a week for at least an hour to two hours, for two semesters.

This means that the Dual Enrollment course has less teacher student interaction and more to

cover within class time, warranting more external independent studies. To counter this disparity

in frequency of classes, I only evaluated each level of thinking for presence. This means I only

applied each of Bloom's levels of thinking to the documents to see if they were present,

regardless of their frequency. It is expected that a course that meets more will have a higher

frequency of each level of thinking, so to accommodate this, I only evaluated for the presence of

each level of thinking.

The results of my research may also be skewed by the fact that I could only compare and

contrast rigor in the classroom between one high school AP Psychology course and two BHCC

dual enrollment Psychology courses. The scale that I chose to apply is also subjective, I selected

it for its simplicity and tangibility. In reality, rigor is indeed a more abstract concept that has yet

to be tamed and measured.

Conclusion and Implications

In the larger frame of academia and accelerated learning programs, this research cannot

conclude any apparent trends in teaching or disparities in rigor. To further the study relating Dual

Enrollment and AP, two programs with the same objective, one will need a larger scope and more consistency in data collection. These revisions will yield more accurate results to reveal the true relationship between these programs.

The educational sphere may still benefit from my attempt to measure rigor in this study. I can confidently conclude after conducting my research that my scale of rigor is not perfect. My usage of Bloom's taxonomy is just one narrow lens that can be shone on rigor. I also only measured the rigor in what was asked of students, not the classroom yields. To sum it up, I conducted my research with the assumption that if a good question is asked, it will entail a good answer. There are more aspects that contribute to a rigorous classroom, and more perspectives to what a rigorous classroom is. Let this attempt open the eyes of other academics in education to the lack of a better (or any) measurement for rigor.

My findings cannot speak for the whole of AP and Dual Enrollment, but it has made one thing apparent: these two courses within the Malden Public Schools are not equivalent. Within the parameters of this high school system, this research can conclude that these courses should not be awarded the same credit.

Appendix A

Defining Rigor by Julie Edmunds
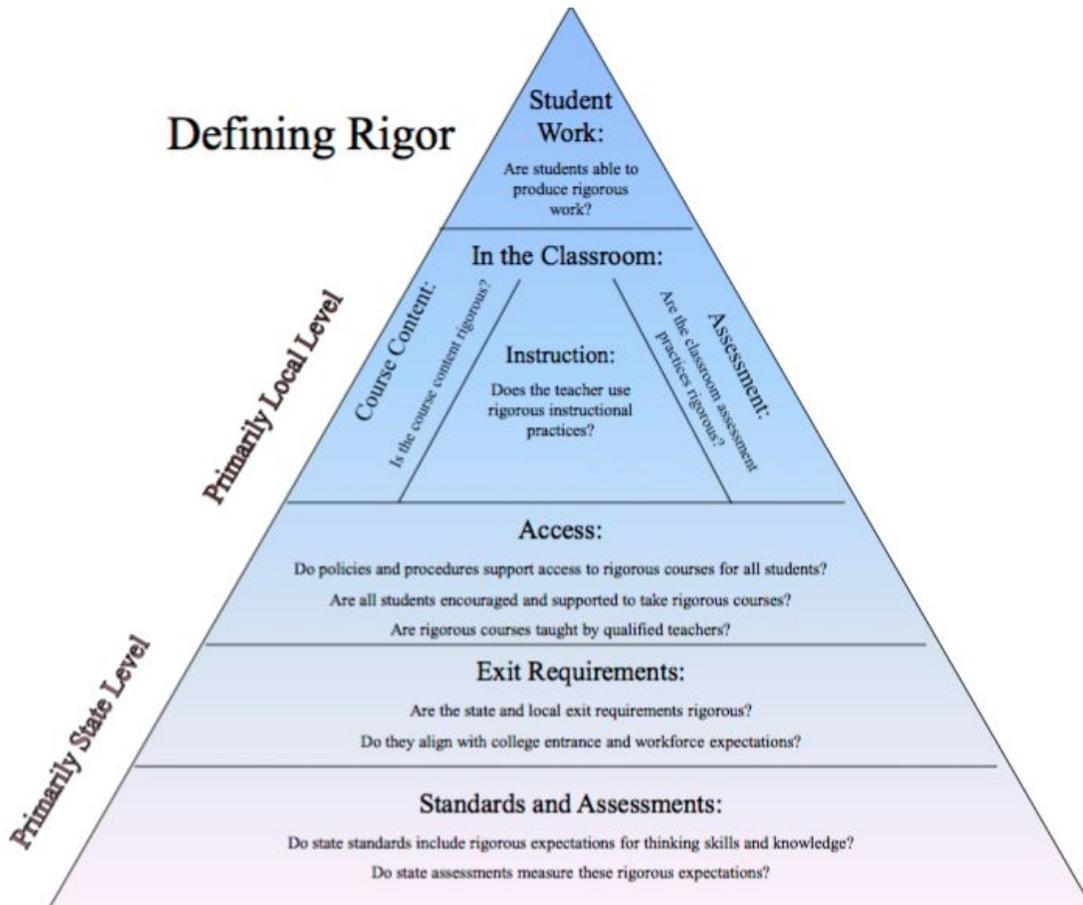
(Edmunds, 2016)

Appendix B

Webb's Depth of Knowledge

Table 2

Webb's depth-of-knowledge (DOK) levels (Webb 1997, 1999)

Level	Description
DOK-1	Recall & Reproduction — Recall a fact, term, principle, or concept; perform a routine procedure.
DOK-2	Basic Application of Skills/Concepts — Use information, conceptual knowledge; select appropriate procedures for a task; perform two or more steps with decision points along the way; solve routine problems; organize or display data; interpret or use simple graphs.
DOK-3	Strategic Thinking — Reason or develop a plan to approach a problem; employ some decision-making and justification; solve abstract, complex, or non-routine problems, complex. (DOK-3 problems often allow more than one possible answer.)
DOK-4	Extended Thinking — Perform investigations or apply concepts and skills to the real world that require time to research, problem solve, and process multiple conditions of the problem or task; perform non-routine manipulations across disciplines, content areas, or multiple sources.

Bloom's Taxonomy

Table 1

Comparison of descriptors associated with the cognitive process dimensions of Bloom's original taxonomy (1956) and the revised Bloom's Taxonomy of Anderson and Krathwohl (2001).

Bloom's Taxonomy (1956)	Revised Bloom Process Dimensions (2005)
Knowledge Define, duplicate, label, list, memorize, name, order, recognize, relate, recall, reproduce, state	*Remember* Retrieve knowledge from long-term memory, recognize, recall, locate, identify
Comprehension Classify, describe, discuss, explain, express, identify, indicate, locate, recognize, report, restate, review, select, translate	*Understand* Construct meaning, clarify, paraphrase, represent, translate, illustrate, provide examples, classify, categorize, summarize, generalize, infer a logical conclusion (such as from examples given), predict, match similar ideas, explain, compare/contrast, construct models (e.g., cause-effect)
Application Apply, choose, demonstrate, dramatize, employ, illustrate, interpret, practice, schedule, sketch, solve, use, write	*Apply* Carry out or use a procedure in a given situation; carry out (apply to a familiar task) or use (apply) to an unfamiliar task
Analysis Analyze, appraise, calculate, categorize, compare, criticize, discriminate, distinguish, examine, experiment, explain	*Analyze* Break into constituent parts, determine how parts relate, differentiate between relevant and irrelevant, distinguish, focus, select, organize, outline, find coherence, deconstruct (e.g., for bias or point of view)
Synthesis Rearrange, assemble, collect, compose, create, design, develop, formulate, manage, organize, plan, propose, set up, write	*Evaluate* Judge based on criteria, check, detect inconsistencies or fallacies, judge, critique
Evaluation Appraise, argue, assess, choose, compare, defend, estimate, explain, judge, predict, rate, core, select, support, value, evaluate	*Create* Combine elements to form a coherent whole, reorganize elements into new patterns/structures, generate, hypothesize, design, plan, construct, produce for a specific purpose

Cognitive Rigor Matrix

Table 3
Cognitive rigor (CR) matrix with curricular examples.

Revised Bloom's Taxonomy levels	Webb's Depth-of-Knowledge Levels			
	Level 1 Recall and Reproduction	Level 2 Skills and Concepts	Level 3 Strategic Thinking/ Reasoning	Level 4 Extended Thinking
Remember Retrieve knowledge from long-term memory, recognize, recall, locate, identify	Recall, recognize, locate basic facts, ideas, principles Recall or identify conversions: between units of measure Identify facts/details in texts			
Understand Construct meaning, clarify, paraphrase, represent, translate, illustrate, give examples, classify, categorize, summarize, generalize, infer a logical conclusion, predict, compare/contrast, match like ideas, explain, construct models	Compose/decompose numbers Evaluate an expression Locate points on a grid Symbolize math relationships Write simple sentences Describe/explain how or why	Specify and explain relationships Give non-examples/examples Make and record observations Summarize results, concepts, ideas Infer or predict from data or texts Identify main ideas	Explain, generalize, or connect ideas using supporting evidence Explain phenomena in terms of concepts Write full composition to meet specific purpose Identify themes	Explain how concepts or ideas specifically relate to other content domains or concepts Develop generalizations of the results obtained or strategies used and apply them to new problem situations
Apply Carry out or use a procedure in a given situation; carry out (apply to a familiar task), or use (apply) to an unfamiliar task	Follow simple/routine procedures Solve a one-step problem Calculate, measure, apply a rule Apply an algorithm or formula Represent in words or diagrams a concept or relationship Apply rules or use resources to edit spelling and grammar	Select a procedure according to task needed and perform it Solve routine problem applying multiple concepts or decision points Retrieve information from a graph and use it solve a multi-step problem Use models to represent concepts Write paragraph using appropriate organization, text structure	Use concepts to solve non-routine problems Design investigation for a specific purpose or research question Conduct a designed investigation Use reasoning, planning, and evidence Revise final draft for meaning or progression of ideas	Select or devise an approach among many alternatives to solve a novel problem Conduct a project that specifies a problem, identifies solution paths, solves the problem, and reports results Illustrate how multiple themes (historical, geographic, social) may be interrelated
Analyze Break into constituent parts, determine how parts relate, differentiate between relevant-irrelevant, distinguish, focus, select, organize, outline, find coherence, deconstruct (e.g., for bias or point of view)	Retrieve information from a table or graph to answer a question Identify or locate specific information contained in maps, charts, tables, graphs, or diagrams	Categorize, classify materials Compare/ contrast figures or data Select appropriate display data Extend a pattern Identify use of literary devices Identify text structure of paragraph	Compare information within or across data sets or texts Analyze and draw conclusions Generalize a pattern Organize/interpret data Analyze author's craft or viewpoint	Analyze multiple sources of evidence or multiple works by the same author, or across genres Analyze complex/abstract themes Gather, analyze, and organize information Analyze discourse styles
Evaluate Make judgments based on criteria, check, detect inconsistencies or fallacies, judge, critique			Cite evidence and develop a logical argument for concepts Describe, compare, and contrast solution methods Verify reasonableness of results Justify conclusions made	Gather, analyze, and evaluate relevancy and accuracy Draw and justify conclusions Apply understanding in a novel way, provide argument or justification for the application
Create Reorganize elements into new patterns/structures, generate, hypothesize, design, plan, construct, produce	Brainstorm ideas, concepts, or perspectives related to a topic or concept	Generate conjectures or hypotheses based on observations or prior knowledge	Synthesize information within one source or text Formulate an original problem Develop a complex model for a given situation	Synthesize information across multiple sources or texts Design a model to inform and solve a real-world, complex, or abstract situations

(Hess, 2009)

Appendix C

Questionnaire Regarding Assessments (Distributed to AP and BHCC Students)

Psychology Assessment Assessment

These questions are regarding your experience taking BHCC PSY 101 assessments. Please answer
truthfully.

1 - Never
2 - Rarely
3 - Sometimes
4 - Most of the time
5 - Always

* Required

How often were you asked to recall facts and basic concepts? *

	1	2	3	4	5	
Never	O	O	O	O	O	Always

How often were you asked to define terms/vocabulary? *

	1	2	3	4	5	
Never	O	O	O	O	O	Always

How often were you asked to explain ideas or concepts? *

	1	2	3	4	5	
Never	O	O	O	O	O	Always

How often were you asked to discuss what you learned?

	1	2	3	4	5	
Never	O	O	O	O	O	Always

How often were you asked to use information that you learned in new situations? *

	1	2	3	4	5	
Never	O	O	O	O	O	Always

How often were you asked to solve problems using the material you learned?

	1	2	3	4	5	
Never	○	○	○	○	○	Always

How often were you asked to draw connections among ideas? *

	1	2	3	4	5	
Never	○	○	○	○	○	Always

How often were you asked to compare/contrast class material to real life? *

	1	2	3	4	5	
Never	○	○	○	○	○	Always

How often were you asked to justify a stance or decision? *

	1	2	3	4	5	
Never	○	○	○	○	○	Always

How often were you asked to critique an idea?

	1	2	3	4	5	
Never	○	○	○	○	○	Always

How often were you asked to produce a new or original work (such as a making up a scenario or a question)? *

	1	2	3	4	5	
Never	○	○	○	○	○	Always

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Appendix D

Malden High's AP Psychology Student Responses to Questionnaire

How often were you asked to recall facts and basic concepts? (40 responses)
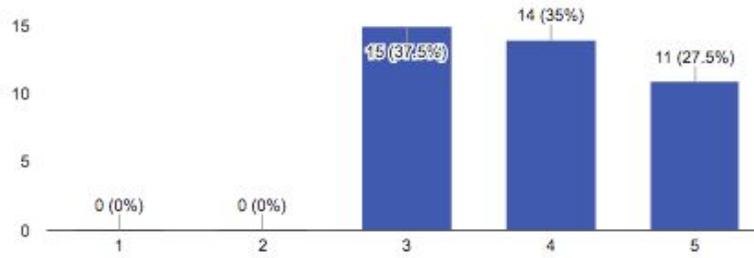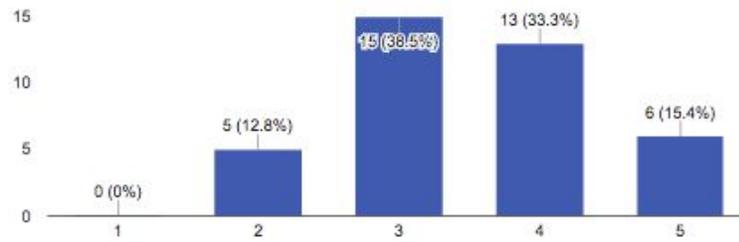

How often were you asked to define terms/vocabulary? (40 responses)
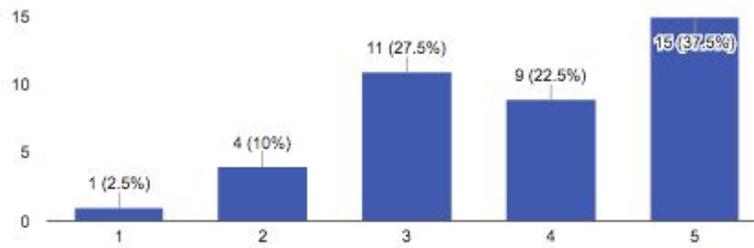
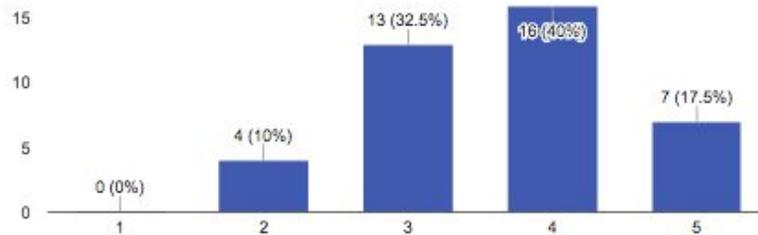How often were you asked to justify a stance or decision? (40 responses)
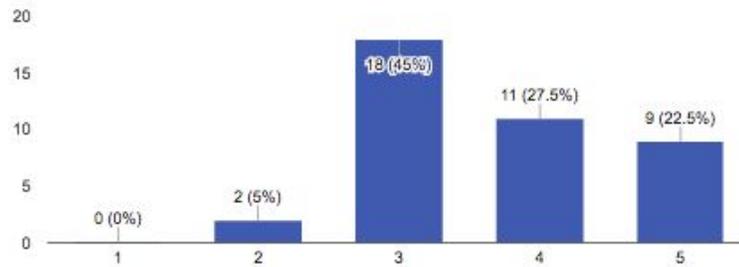
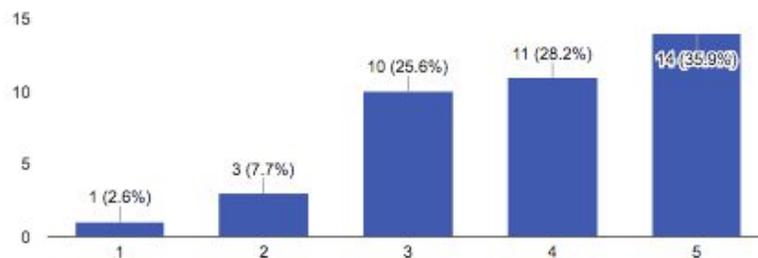How often were you asked to critique an idea? (39 responses)

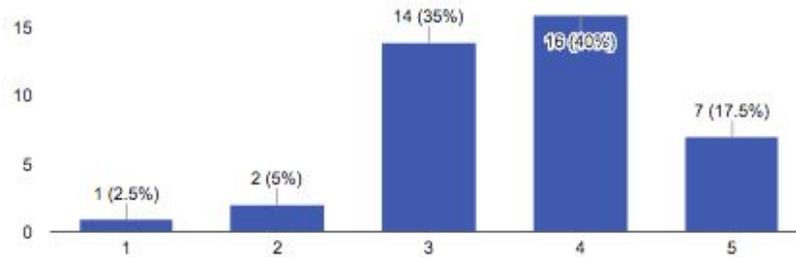How often were you asked to use information that you learned in new situations?
(40 responses)

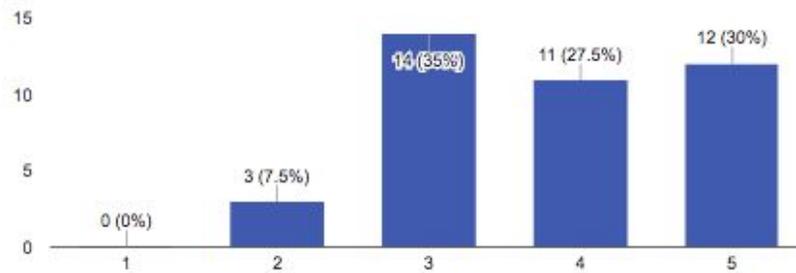How often were you asked to solve problems using the material you learned?
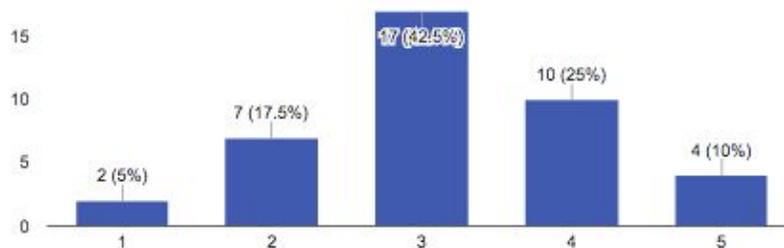(39 responses)

How often were you asked to draw connections among ideas? (40 responses)

How often were you asked to compare/contrast class material to real life? (40 responses)

How often were you asked to produce a new or original work (such as a making up a scenario or a question)? (40 responses)

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