Facilitating Undergraduate Learning through Community-Engaged Problem-Based Learning

Ronica N. Rooks[1] and Brooke Dorsey Holliman[2]

[1]University of Colorado Denver
[2]Denver Veterans Affairs Medical Center

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We used problem-based or experiential learning in our undergraduate Health Policy course to examine food deserts via a health impact assessment (HIA) assignment. A HIA evaluates potential effects on population health before a policy/program is implemented, to improve health and reduce adverse outcomes. We investigated if the HIA assignment facilitated student learning using mixed-methods to descriptively analyze students' pre-/post-test and peer group assessment surveys, guest lecture reflections, mid-semester evaluations, and HIA research paper reflections. Quantitatively, students' pre-/post-test ratings of their learning decreased from positive to neutral Likert scale scores, but they rated their group work positively over time. Qualitatively, students learned from community speakers and their research about the challenges of health policy as a pluralistic process and solutions to reducing food insecurity. But, they needed more detailed instructions for their HIA assignment earlier in the semester.

INTRODUCTION

Problem-based learning (PBL) in public health is often a learning technique used at the graduate level through practicum experiences. However, PBL can be a beneficial practice for undergraduates to learn skills and determine their career paths. PBL is experiential or active learning, where students learn through direct personal encounters and reflection to build on past knowledge and experiences (Burnard, 1987, 1992). It usually includes presenting a problem to small student groups, where they try to explain and resolve the problem through research and peer-learning discussions. PBL's goals are to foster students' problem-solving skills, acquisition, retention, and use of knowledge, self-directed learning, and intrinsic interest or meaning in a topic (Norman & Schmidt, 1992). Research in the health sciences also suggests that PBL activates prior knowledge; enhances causal thinking related to the pathophysiologic processes underlying disease; and fosters the transfer of concepts learned to new problems (Norman & Schmidt, 1992). PBL students frequently have better analytical and communication skills; greater appreciation for the cultural, legal, and ethical aspects of health and healthcare; demonstrate greater responsibility; and are better able to cope with uncertainty than their peers in traditional curriculums (Norman, 2008).

However, PBL requires more resources and time than traditional curriculums (Mamede, Norman, & Schmidt, 2006; Norman & Schmidt, 1992). It involves more labor-intensive teacher-student interactions, where students need to receive corrective feedback during their attempts to solve a problem. Most PBL literature focuses on medical students' or health professionals' education (Mamede et al., 2006; Norman, 2008; Yuan, Williams, & Fan, 2008). PBL in public health tends to focus on graduate students (Gurpinar, Musal, Aksakoglu, & Ucku, 2005), with little attention on undergraduate students (Spinello & Fischbach, 2004), particularly in health policy courses.

For our co-taught, undergraduate Health Policy course, a required course for Public Health majors, we used PBL to translate public health science into policy action through community case studies, experiential research, and group learning (Hearne, 2008). From a PBL perspective, we designed our health impact assessment (HIA) (i.e., a combination of procedures, methods, and tools to judge a policy's, program's, or project's potential effects on population health and the distribution of those effects) (Centers for Disease Control and Prevention, 2010) paper. Our HIA also uses a "Health in All Policies" framework, a perspective focused on the social determinants of health implications for policy. This effort addresses the Institute of Medicine's recommendations to improve public health professionals' training by including some competency in policy development and advocacy (Gebbie, Rosenstock, & Hernandez, 2003).

Our PBL approach focused on students doing a policy analysis on food insecurity in a local community using a HIA. A HIA is a support tool for policy-makers to improve health, reduce adverse outcomes, and assess health inequalities in identified policies (Metcalfe & Higgins, 2009). The goal of this assignment was to encourage innovative, applied learning, where students would gain the ability to combine their theoretical knowledge of textbook concepts with real-world experiences in class discussions and research conducted outside of the classroom.

Writing a policy analysis via a HIA combined the academic rigor of research, peer group work, lectures, and practice through community member interactions to actively involve students in the research and policy solutions to food insecurity. For the first part of the HIA paper, each student small group focused on screening, scoping, and assessing risks and benefits. Students then worked independently on the second part of the paper, including: recommendations, reporting, evaluation and monitoring, their reflections on their individual, group, and community experiences, and a one-page policy brief. Student engagement with community members was part of the HIA paper to facilitate undergraduate learning about community-based interventions and solutions. We wanted students to reflect on the value of involving community members in the research and policy-making process to address local health disparities. We integrated some community-based participatory research (CBPR) principles with students' HIA papers, such as direct community involvement, partnership in gathering, using, and interpreting local data, and dialogue (O'Brien & Whitaker, 2011), despite this assignment being narrower in scope than a long-term CBPR project.

The importance of food insecurity as a health policy issue is underscored by the Obama administration's $32 million Healthy

Food Financing Initiative (HFFI). Created in 2012, the initiative was committed to the goal of eliminating food deserts in the United States of America in seven years. Food deserts are neighborhoods with no or distant grocery stores but an abundance of fast food restaurants and other retail outlets offering little or no nutritious food (Gallagher, 2006). A lack of healthy food options can lead to higher rates of obesity, diabetes, cardiovascular diseases, and other health-related issues. Research suggests that access to healthy food in neighborhoods is associated with a health-promoting diet, and poor access is associated with poor health outcomes (Karpyn & Axler, 2006). However, the impact of food deserts goes beyond health (Treuhaft & Karpyn, 2010). Low-income communities are isolated from the benefit of economic development associated with having local grocery stores, such as the creation of steady jobs with living wages and prompting the growth of other complementary retail stores and services nearby. The HFFI is one solution to the problem of limited access to healthy foods and can reduce health disparities, improve the health of families and children, create jobs, and stimulate local economic development in low-income communities.

In preparing to teach this assignment in a new course, we first applied for internal funding focused on enhancing curriculum and teaching. This funding paid for summer research assistance, prior to teaching the course in the following spring semester, to develop the HIA paper based on current research, submit an IRB application, mentor a graduate student in my department on incorporating research into teaching, and frame a scholarship of teaching and learning article. Second, we researched literature on how to do an HIA and the connection between food insecurity, neighborhoods, health, and health policy communicated with and learned from a local community group addressing food insecurity. Third, based on our research, we found two HIA case studies in the U.S. to use as examples and guide students in their research (Dannenberg et al., 2008; Tri-County Health Department, 2007). Fourth, we created or found different data collection tools to assess students' perceived learning. We created guest lecture reflection and mid-semester assessment questions. We found peer and self-assessment and pre-/post-test surveys in the problem-based and experiential learning literature to administer to students during the semester to monitor small group dynamics, assess each group members' workload contributions to the paper, and understand students' perceptions of learning based on their community-engaged work.

This research investigated if the HIA paper in our Health Policy course facilitated undergraduate students' perceptions of learning. We invited speakers from "Taking Neighborhood Health to Heart" (TNH2H) (Main et al., 2012), a community-university partnership, for students to apply their course knowledge to community-engaged research and peer group work. TNH2H focuses on learning about and improving the health and well-being of people living in five partner neighborhoods in the Denver metropolitan area and has a well-established connection with these communities based on a prior grant from the National Heart, Lung, and Blood Institute. We hypothesized that using PBL through the HIA paper would enhance students' perceptions about their learning in the course. In particular, we believed that students working on the HIA paper would increase their knowledge, applying health policy to the topic of food insecurity, problem-solving skills, communication skills, and understanding of cultural, ethical, and legal issues associated with health and healthcare. We examined students' perceptions of their learning during their assignment research and completion using multiple data sources and quantitative and qualitative methods.

METHODS

Study Design/Sample

This study examined the PBL experiences of students, aged 18+, enrolled (n=60) in a required undergraduate Health Policy course during 2012. A research assistant obtained informed consent from students four weeks into the course. Students were able to turn their consents in immediately or by semester's end to assure their consent to participate (or not) would not impact their paper or course grades. While the assignment was mandatory for the course, students were able to opt out of having their HIA paper collected as data for this research project. They could refuse participation in this research at any time, for any reason. If students did not provide consents, their surveys and papers were removed from the study. We used mixed-methods, descriptively analyzing students' pre-/post-test surveys, peer group assessment surveys, guest lecture reflections, mid-semester evaluations, and HIA paper reflections. Using quantitative descriptive statistics and qualitative content analyses as mixed methods is beneficial for data triangulation and provides generalizability and contextual-depth to our analyses (Borkan, 2004). Our final sample consisted of 53 Public Health majors and/or minors who consented to participate in this research, with varying sample sizes dependent on attendance for each mode of data collected. This study was approved by the Institutional Review Board at the University of Colorado Denver.

For both of our surveys, we created four categories for the goals of PBL in the literature [e.g., knowledge (K), problem-solving skills (PS), communication skills (C), and cultural, legal, and ethical aspects of health and healthcare (CLE)], to apply PBL to this research on students' perceived learning. Each survey question represents at least one of these four operational categories for PBL. For knowledge, students applied health policy concepts to the problem of food insecurity in a local community, while gaining insight about food insecurity and local policy solutions; and they developed their independent and small group research and writing skills. For problem-solving skills, students overcame the challenge of coordinating multiple steps among different small group members for the HIA paper and gained group work habits. For communication skills, students worked together on the HIA paper by inquiring with faculty, the community, and their peers in the small groups. And, for cultural, ethical, and legal considerations for health and healthcare, students invested their knowledge and time to do research on and create policy solutions for a community that most of them were unfamiliar with, and had a larger racial and ethnic minority and lower socioeconomic status population. They also overcome challenges of working with students from different racial and ethnic, cultural, and socioeconomic status backgrounds, whom they did not know very well at the beginning of the course.

First, we asked students to complete pre-/post-test surveys, including socio-demographic characteristics and questions aimed at assessing their community-engaged, course experiences with space for open-ended comments (Gelmon, Holland, Driscoll, Spring, & Kerrigan, 2001). We administered the pre-test within the second week and the post-test (i.e., the same as the pre-test, except questions were asked in past tense) during the last week

of the course. Pre- and post-test sample sizes were 53 and 47 students, respectively.

Second, students responded to peer group assessment surveys twice, after mid-semester evaluations and after the HIA paper was due at the end of the semester (n=43 and n=46). These surveys measured peer and self-assessments of each group member's contributions to the first part of the HIA papers (Asgari & Dall'Alba, 2011). We monitored group interactions to ensure cohesion and an equally distributed workload within groups.

Third, students wrote their reflections on three community group guest lectures, where sample sizes varied by student attendance for each event (n=51, 52, and 53). The lectures included: a panel of community residents in the TNH2H partnership discussing their food access difficulties; academics working in another community focused on how policy interventions impact food and food systems; and a TNH2H community resident who described the group's advocacy efforts, via a food committee, to address food access difficulties through local grocery retailers and legislation. After each lecture, students were asked to respond to three questions:

1. Did the speakers discuss any information that you could use for your HIA paper? Please explain.
2. If so, how will you use this information to guide your next steps for your paper?
3. If not, please describe what information or topics you would like your professors and/or future speakers to address.

Fourth, students filled-out mid-semester evaluations (n=32). Evaluations asked about students' course expectations; if the readings and other course requirements were appropriate, such as the HIA papers; overall what was working well or not in the course; and what students' suggestions were for faculty to improve the course.

Finally, students were required to include a section in their HIA paper reflecting on their individual, small group, and community experiences (n=53). The purpose of this assignment was to develop students' scholarship through research, professional networking, and service to the community, contributing to policy solutions. By encouraging innovative learning we hoped students would gain the ability to combine their theoretical knowledge of textbook concepts with real-world experiences in class discussions and research.

MEASURES

Our dependent variable was students' perceptions of their learning, measured quantitatively in the pre-/post-test and peer group assessment surveys and qualitatively in students' guest lecture reflections, mid-semester evaluations, and HIA paper reflections. In the pre-/post-test survey we used two items to assess student learning: 1) community participation in this course will help me to see how course material I learned can be used in everyday life; and 2) the community work I will do through this course will help me to better understand the material from my lectures and readings in this course. These survey items used Likert scales (e.g., 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, and 5=strongly agree). In the peer and self-assessment surveys we assessed student learning by using the survey item, "the problem solving component of the course improved my learning skills," as the dependent variable. This survey item used a Likert scale (e.g., 1=strongly agree, 2=agree, 3=don't know, 4=disagree, and 5=strongly disagree). The remaining pre-/post-test and peer-group survey questions served as the independent variables for quantitative descriptive statistics. For the qualitative data, we sought content emphasizing what students perceived they learned, the facilitators and barriers to their learning, and how they would use this information for their HIA papers.

Statistical Analysis

Our quantitative descriptive statistics included: frequencies for students' socio-demographic characteristics; means from paired-sample t-tests for the pre-/post-tests with the d statistic for effect size differences; means from one-way ANOVA tests for both student learning items from the post-tests by each remaining survey item; means from one-way ANOVA tests for the peer group and self-assessment surveys from time 1 and 2; and means from one-way ANOVA tests for the student learning item from the peer group and self-assessment surveys by each remaining survey item from time 1 and 2. We also used qualitative content analysis on students' guest lecture reflections, mid-semester evaluations, and HIA paper reflections. The authors independently coded students' guest lecture reflections and mid-semester evaluations using content analysis. In addition, two student research assistants independently coded the HIA paper reflections using content analysis. We identified common themes based on the described purpose and questions asked with each data source in the prior study design section. Our qualitative analysis proceeded as follows, we: 1) created a list of student responses to each question with quotes in Excel; and 2) identified a list of common themes repeatedly mentioned by students.

RESULTS

Quantitative Results

Table 1 shows summary statistics of students' socio-demographic characteristics from the pre-/post-test surveys. The majority of students were aged 18-24, female, Caucasian/White, junior classman, and working between 1-20 hours a week at pre-/post-test.

Table 2 shows paired-sample t-test results for students' pre-/post-test surveys. Overall, there were more significant decreases than increases on the Likert scale (e.g., 1=strongly disagree to 5=strongly agree) for students connecting community engagement as PBL to students' perceptions of learning over time. A decrease on this scale over time meant less agreement with the item statements. Generally, students believed that the community work was a little less helpful for learning the course material over time. But, there was a significant increase over time for students who believed their community work would enhance their ability to communicate in a real-world setting ($p=0.035$, $d=-0.38$).

We conducted one-way ANOVA tests for the post-test student learning questions by each remaining item in the survey (table not shown). On the post-test survey, both student perceived learning outcomes (e.g., community participation in this course helped me to see how course material I learned can be used in everyday life and the community work I did through this course helped me to better understand the material from my lectures and readings in this course) were significantly and positively associated with the following items: combining community work and university coursework should be practiced in more courses ($p<0.001$ and $p=0.004$); the community work for this

Table 1. *Summary Statistics of Students' Socio-Demographic Characteristics from the Pre-/Post-Test Surveys*

		Pre-test n=53	Post-test n=47
Age	18-19	18.9% (10)	12.8% (6)
	20-24	60.4% (32)	63.8% (30)
	25-29	11.3% (6)	14.9% (7)
	30-34	5.7% (3)	4.3% (2)
	35+	3.8% (2)	4.3% (2)
Gender	Male	18.9% (10)	21.3% (10)
	Female	81.1% (43)	78.7% (37)
Race/ Ethnicity	Caucasian/White	52.8% (28)	55.3% (26)
	African American/Black	17.0% (9)	17.0% (8)
	Hispanic/Latino	7.5% (4)	12.8% (6)
	Asian/Asian American	11.3% (6)	4.3% (2)
	Native American	1.9% (1)	2.1% (1)
	Other	3.8% (2)	2.1% (1)
	Multiracial	5.7% (3)	6.4% (3)
Class Level	Sophomore	5.7% (3)	4.3% (2)
	Junior	54.7% (29)	51.1% (24)
	Senior	32.1% (17)	36.2% (17)
	Other	5.7% (3)	8.5% (4)
Hours Worked per Week	1-20 Hours/Week	43.4% (23)	46.8% (22)
	21+ Hours/Week	34.0% (18)	34.0% (16)
	I do not have a job	22.6% (12)	19.1% (9)

Source: *Health Policy undergraduate students in 2012.*
Notes: *Our original pre-test (n=53) and post-test (n=47) sample sizes varied due to: 1) differences in those students who began the course, prior to the drop/add period, and those who finished the course and 2) absences on the days the surveys were administered.*

course will benefit the community (p<0.001 and p=0.001); interactions with the community will enhance learning (p=0.010 and p=0.004); community work will help with awareness of personal strengths and weaknesses (p=0.011 and p=0.015); community work will enhance communication ability in a real world setting (p=0.024 and p=0.010); community work will help to develop problem-solving skills (p=0.004 and p=0.007); and other students will play an important role in learning (p=0.001 and p=0.050). A significant and positive association also existed between "The community work I will do through this course will help me to better understand the material from my lectures and readings in this course" and feeling a personal responsibility to meet the needs of the community partner of this course (p=0.013).

Table 3 shows the mean peer- and self-assessment survey results. The average rating for whether each member fulfilled his/her participation responsibilities in completing the group half of the HIA paper was very positive with no significant change from time 1-2 (1.20 and 1.22), where this item rating ranged from 1=outstanding to 7=no help at all. The ten survey questions were based on a Likert scale, where 1=strongly agree and 5=strongly disagree. An increase on the scale over time meant less agreement with the item statements. Significant change in responses over time included students' agreeing or strongly agreeing that: the group work instructions were sufficient (p=0.034); there was no conflict in personal relationships with other group members (p=0.002); there was no conflict during the process of this assignment (p=0.022); I could freely express my opinion in my group (p=0.003); I was satisfied with the learning outcomes (p=0.006); and the problem solving component of the course improved my learning skills (p=0.031).

For the peer and self-assessment surveys, we used one-way ANOVAs to compare the mean responses on the student learning item "The problem solving component of the course improved my learning skills" to the remaining items in the survey for time 1 and time 2 (table not shown). At time 1, we found a significant and positive association between students' perceived learning and the following items: providing sufficient instructions for the group work (p=0.011); not having group conflict during the process of this assignment (p=0.039); satisfaction with the team work assessment process (p<0.001); and satisfaction with the learning outcomes (p<0.001). Our dependent variable was also significantly and inversely associated with a preference to do assignments individually rather than as a group (p=0.022). At time 2, students' perceived learning was significantly and positively associated with not having group conflict during the process of this assignment (p=0.048) and satisfaction with the learning outcomes (p<0.001).

QUALITATIVE RESULTS

A number of themes occurred in students' reflections on our three separate guest lectures, which we paraphrased in bullet points below. In response to the first group of TNH2H community speakers, students wrote that they gained:

- a better understanding of the local Denver community affected by food deserts, some history on this community, and how the community adapted and/or worked toward change.
- knowledge about positive interventions to address food insecurity and public health problems in general.

The next pair of academic speakers addressed food deserts in another local Denver community and reducing childhood obesity via physical activity in schools as a consequence of food insecurity. Students learned:

- the process of making and creating policies from public health professionals.
- the inter-relationships between policy issues in health and education.
- how communities are affected by and react to policies.
- solutions to food deserts, such as urban gardening and nutrition.
- challenges in the process of finding solutions, such as zoning, time evaluation and funding for programs, and the consideration that food deserts are only one part of the social determinants that need addressing in this local Denver community.

The final speaker discussed the TNH2H food committee's efforts to get a new grocery store in this community. Students commented on and gained insight about:

- the association between health and food policy situated within the economy, politics, and education.
- differing viewpoints on food desert solutions, fostering critical thinking and risk and benefit assessment.
- a broader solution to food insecurity, via an initiative by the Colorado Center on Law and Policy to increase economic security.

Table 2. *Paired-Sample T-Test Results for Students' Pre-/Post-Test Surveys*

Item Statement	PBL	Pre-test mean	Post-test mean	Mean difference	p-value	Effect size, d
1) The community participation aspect of this course will help me to see how course material I learned can be used in everyday life.	K, CLE	4.18	3.88	0.30	0.006	0.51
2) The community work I will do through this course will help me to better understand the material from my lectures and readings in this course.	K, CLE	3.97	3.74	0.23	0.088	0.30
3) The idea of combining work in the community with university coursework should be practiced in more courses at this university.	K, CLE	4.06	3.88	0.18	0.226	0.21
4) I feel that the community work I will do through this course will benefit the community.	CLE	4.09	2.88	1.21	<0.001	1.37
5) I will be able to work directly with a community partner through this course.	K, CLE	3.79	2.91	0.88	<0.001	0.85
6) I feel a personal responsibility to meet the needs of the community partner of this course.	K, CLE	3.88	3.09	0.79	<0.001	0.74
7) My interactions with the community partner will enhance my learning for this course.	K, C, CLE	4.00	3.56	0.44	0.041	0.36
8) Doing work in the community will help me to become aware of my personal strengths and weaknesses.	K	4.15	3.56	0.59	0.002	0.58
9) The community work involved in this course will make me aware of some of my own biases and prejudices.	K	3.76	3.62	0.14	0.508	0.11
10) The work I will perform in the community will enhance my ability to communicate in a real world setting.	K, C, CLE	3.50	3.88	-0.38	0.035	-0.38
11) The community aspect of this course will help me to develop my problem-solving skills.	PS, CLE	4.06	3.79	0.27	0.130	0.27
12) The syllabus provided for this course outlined the objectives of the community work in relation to the course objectives.	K	3.88	2.85	1.03	<0.001	1.10
13) The other students in this course will play an important role in my learning.	K, C, PS	3.71	3.62	0.09	0.661	0.08
14) I have the opportunity in this course to periodically discuss my community work and its relationship to the course content.	K, C	3.82	3.41	0.41	0.017	0.43

Source: *Survey questions from Gelmon et al. (2001) for Health Policy undergraduate students in 2012.*
Notes: *Questions 1-18 are based on a Likert scale representing 1=strongly disagree to 5=strongly agree. A decrease on the scale over time meant less agreement with the item statements. After we matched the pre- (n=53) and post-test (n=47) surveys a sample size of 34 students remained. We coded the unmatched surveys as missing data. We created four categories for the goals of PBL in the literature [e.g., knowledge (K), problem-solving skills (PS), communication skills (C), and cultural, legal, and ethical aspects of health and healthcare (CLE)], to apply PBL to these survey items associated with students' perceived learning.*

Students were asked how they would use the information from our guest lectures for their HIA papers. We summarized their comments on the following areas:

- planning visits to the community, particularly local grocery stores to compare prices and distance traveled, and making comparisons to the U.S. Department of Agriculture's food pyramid.
- developing interview questions on food deserts and solutions from community members' perspectives.
- constructing a demographic summary on food insecurity and then evaluating what tools are available in the area.
- learning how poor nutrition affects different community members in regards to race, ethnicity, socioeconomic status, and age.
- learning about the community's historical difficulties with crime, violence, economic changes, and transportation.
- the complexity of the food desert issue, considering: healthy eating, food production and distribution, farmers' markets, urban gardening, exercise, evaluating the environment of the community, zoning laws, tax breaks, subsidies, urban planning, the built environment, and health disparities.
- gaining familiarity with policymaking and a framework to analyze situations and improve policy, including thinking about food deserts from policy makers' and city planners' perspectives.
- resources and strategies to use, such as a food desert locator website, Revision International, the Live Well Colorado wellness programs for healthy communities, ride shares, community supported agriculture distribution, and grassroots support.

Students were asked about what information or topics they would like to receive more information about, related to their HIA papers and improving students' perceived learning. We summarized their comments on the following areas:

- more details about the history, demographics, social and economic conditions (such as "white flight" and retail exodus associated with food deserts), access to healthcare in the neighborhood, and how these issues might affect the community's health.
- what is being done to evaluate and improve the built environment and other aspects of these neighborhoods.
- gaining more information on food policy laws, such as: Are there current policies in Colorado adding to these community difficulties or making things better for them

to solve the food desert problem? Are there state and/or local government or non-government programs to address food insecurity? What incentives exist to attract healthy food outlets at the state and city level?

- gaining more information on the TNH2H partnership, neighborhood food vendors, and other resources as potential contacts for their HIA papers.
- having a guest speaker to outline a HIA he/she completed.
- considering what "deliverables" students should focus on for the community.

When students were asked in their mid-semester evaluations if this course was meeting their expectations or not, about half of respondents said yes. Some students thought that expectations were met in terms of the content learned; however, they were not met in terms of the way the content was presented, particularly in reference to confusing HIA paper instructions. When students were asked what worked well in this course, they mentioned the following: the in-class and group activities; the guest speakers; and the lecture PowerPoint slides, charts, and other visuals (e.g., film clips and concept/mind mapping) in applying and understanding class and reading content. One student noted: "The group activities are good for this course because it helps us apply the concepts learned."

Students also stated what was not working well, including: the high volume of information presented in short periods of time; confusing HIA paper instructions, with the need for more clarity early in the semester; and not allowing students a choice in selecting and examining a food desert neighborhood or other topic for the HIA paper. A note of constructive criticism from one student:

> *I do not dislike anything in particular, however, if I were to suggest a change/improvement it would be to reconstruct the HIA project. Organize the groups (assign) and do not restrict to one neighborhood or topic.*

Another student noted his/her difficulties: "I dislike the amount of information in each lecture, it is very hard to follow. Some instructions are not clear."

Common themes from students' HIA paper reflection sections included: first impressions, community experiences, group work, and learning from the HIA. Under *first impressions* many students felt overwhelmed by the amount of work required and/or frustrated by their initial reading of the HIA paper in the syllabus. However, they mentioned instructions and the paper became clearer and more manageable as the semester progressed. These opinions were expressed by one student when he/she wrote:

> *…individually I felt the HIA could have been better taught and presented. [If] The initial directions were clearer, this assessment would not have been so frustrating. I enjoyed doing the assessment and researching about the different solutions to eradicate food deserts after the assignment became clear.*

Another student also felt this way:

> *When this was first assigned it was really difficult for me to understand what I had to do and what was exactly wanted from me. It was really confusing in the beginning, but every time we discussed the paper in class it became more and more clear.*

Under *community experiences* many students gained a better understanding of food deserts and their impact on health. A student wrote in his/her final paper: "I……appreciate the guest lecturers because they helped apply what we were learning in class to the real world." Some were motivated to become more involved in the TNH2H community or their own communities, hoping their involvement would make a difference. One student noted:

> This project has given me the chance to get to know the community I live in…Since the time I started working on the HIA paper, I got involved with two more community based organizations that are trying to bring better changes into the community. Overall, this project has opened my eyes on how important it is to be an active member of my community.

TABLE 3. *Mean Peer- and Self-Assessment Survey Results*

	PBL	Time 1	Time 2	p-value
Overall average group rating (n=39).		1.20	1.22	ns
1. I found the instructions provided with regard to group work sufficient (n=38).	K, PS, C	2.61	2.18	0.034
2. Within our group, we had no difference in opinion about the *task* (i.e., what each group member needs to do for the group portion of the HIA paper) (n=39).	PS, C	1.67	1.67	ns
3. Within our group, I had no conflict in *personal* relationships with other group members (n=39).	K, PS, C	1.18	1.64	0.002
4. Within our group, we had no conflict during the *process* of this assignment (n=39).	PS, C	1.49	1.92	0.022
5. Within our group, I could freely express my opinion (n=39).	C	1.21	1.49	0.003
6. If I had a choice, I would have changed my group (n=39).	PS	4.38	4.13	ns
7. I prefer to do the assignments on my own rather than as a group (n=39).	PS	2.92	2.90	ns
8. I am satisfied with the processes for team work assessment, including peer assessment (n=38).	PS, C	2.05	2.18	ns
9. I am satisfied with the learning outcomes (n=38).	K	2.34	2.03	0.006
10. The problem solving component of the course improved my learning skills (n=38).	K, PS	2.53	2.32	0.031

Source: *Health Policy undergraduate students in 2012.*
Notes: *The first overall assessment question was based on a Likert scale of 1 for outstanding to 7 for no help at all. Questions 1-10 were based on a Likert scale, representing 1 for strongly agree to 5 for strongly disagree. An increase on the scale over time means less agreement with the item statements. We created four categories for the goals of PBL in the literature [e.g., knowledge (K), problem-solving skills (PS), communication skills (C), and cultural, legal, and ethical aspects of health and healthcare (CLE)], to apply PBL to these survey items associated with students' perceived learning.*

Most students thought this part of the assignment was a rewarding experience, but some students expressed uncertainty of what their roles were in the community for the project. They reported feeling like an "outsider" in the community because their role was an observer. Other students had no direct communication with TNH2H community residents. A student articulated this in his/her paper by writing:

> *Going to the meetings that were already running by people in the community made it feel like being an outsider and there wasn't time to build a real relationship with those in the community. This outsider feeling made the community portion for the assignment also feel somewhat unnerving and stressful as we wanted to make sure that we didn't overstep, but there wasn't a clear definition of what our roles should be when interacting with community members.*

Under *group work* there were mixed outcomes, where students were evenly divided on liking and disliking the group part of the HIA paper. Positive responses included: class members contributed equal amounts of work, met deadlines, and critically evaluated one another, while negative responses contradicted the positive responses. A positive response from a student stated:

> *…my HIA group was very responsive and hard-working. Even though we were confused about the topic and actions needed in order to make this learning experience successful at first, we were still able to figure out what we needed to do…Everyone in the group understood me and allowed me to express my opinion freely. They made this HIA more enjoyable…*

A second student noted:

> *I enjoyed working as a group on this project because it gave me the chance to get to know my classmates. We were able to share our different viewpoints on public policy and learn from each other.*

A third student wrote:

> *The most challenging part of working in a group was ensuring that all group members were doing an equal amount of work. For example, some people had to include more information in their part and ended up doing more work than others. In addition, it was hard to find days where everybody could meet, and not all team members were able to meet deadlines.*

Under *learning from the HIA* almost all students stated that this assignment was a beneficial experience in multiple ways. Students gained an awareness of food insecurity issues as a social determinant of health, worked with their classmates, better understood policy structure and implementation, and had to critically analyze intervention strategies for public health issues. One student noted:

> *While I was doing my research for the paper, I was surprised to find out the magnitude of [the] food desert problem considering…we are living in one of the most developed countries in the world, America. It was astonishing to be able to learn about the real aspects of public policies and their influence on people's health outcome[s]. I learned how certain groups of people are disproportionally affected by lack of access to health food, and how that can lead to health disparities.*

Another student wrote:

> *When I first heard about the HIA paper I was thinking of dropping the class because I am taking 5 classes…I am glad I decided to stay in this class because I have learned so much about our community…Taking this class and being part of this educational research taught me important things about health disparities among minorities and other ethnic groups…taking this class… made me realize that I can make a difference in my community by participating on research like [the] HIA.*

DISCUSSION

We hypothesized that a HIA paper with the TNH2H community-university partnership would facilitate students' perceived learning in our Health Policy course. Using multiple sources of quantitative and qualitative data collected from students, our results confirmed our hypothesis and were generally positive. The pre-/post-tests showed students were less likely to rate their learning from the HIA paper positively over time. However, students' final ratings were neutral on the Likert scale. Bivariate means from the pre-/post-tests showed positive associations between students' community and peer work with their perceived learning for the course. Students' peer group surveys consistently rated the group part of the HIA paper very positively. Peer group surveys also showed positive associations between students' perceived learning and their satisfaction with the learning outcomes and not having group conflict during the process of this assignment.

In addition, results for the pre-/post-test and peer group surveys showed better scores over time for some of the PBL learning goals in the literature. The pre-/post-test in Table 2 covered all four of our stated goals, but knowledge, communication skills, and cultural, legal, and ethical aspects of health and healthcare associated with community work on food insecurity were prominent. Gaining knowledge by applying health policy to community-engaged research and communicating about this research in a real-world setting were the highest ranked scores, showing improvement over time. The peer group survey in Table 3 covered three of our four PBL goals, including: knowledge, communication, and problem-solving skills. The lowest scores, showing the best scores in this survey over time, involved problem-solving and communication skills, in terms of working in groups to do tasks for the HIA paper, the ability to express individual opinions within groups, and not having conflict within groups.

The most important themes from students' guest lecture reflections included learning about community solutions, institutional inter-relationships (e.g., social determinants of health), and policy-making challenges to reduce food insecurity. Themes from students' mid-semester evaluations reiterated their positive guest speaker reflections and helpful group work, but indicated they needed more detailed instructions for their HIA paper earlier in the semester. HIA paper reflections included four themes: first impressions, community experiences, group work experiences, and perceived learning, which overlapped with our mid-semester evaluations and quantitative findings. Students had confusing first impressions of the paper and felt overwhelmed, but our improved instructions and additional lecture discussions over time helped to improve their understanding of the paper. Community and group work experiences were positive aspects of the HIA paper that fostered learning of course material. Students gained a greater understanding about food insecurity as a social determinant of health as well as community group interventions to change policy structure.

From a "Health in All Policies" framework students learned that health policy is a pluralistic process. Our guest speakers and the food insecurity research students completed for their HIA papers reinforced the idea that policy decisions are made at multiple levels of society including: state and local governments, community and advocacy groups, businesses, schools, universities, and individuals. The organizations involved in the policy process to address food insecurity did not all target health directly, but they did address social determinants of health such as education, the economy, politics, and neighborhoods. Moreover, in learning this framework, students who actively involved themselves with TNH2H or other neighborhood organizations seemed to gain a better learning experience from the HIA paper. This form of self-directed student learning for knowledge acquisition also aligns with a PBL goal.

Despite some logistical difficulties with preparing this new course and simultaneously doing scholarship of teaching and learning research, most students learned from this community-engaged assignment. We had guest speakers who were available for problem-solving interactions with students after their lectures via email or telephone. Consequently, some students were prompted to think about the long-term impact of living in food desert communities and becoming more active in their communities. As part of PBL, we monitored this assignment during the semester, via all of the data collected, and continued to foster student discussions about their HIA paper understanding during and after class. Thus, we were able to improve the assignment clarity progressively before the semester ended. As a positive result of PBL, we realized that students learned from each other in their groups. We were surprised that most groups did additional work beyond the assignment requirements, including: attending community group meetings, conducting pilot surveys, informally interviewing neighborhood residents about food insecurity and their solutions, and/or taking "windshield" tours (i.e., driving through a community to directly observe and describe its physical and social characteristics, possibly as a way to inform health promotion efforts) (McGuirt, Jilcott, Vu, & Keyserling, 2011) of the neighborhood. These students' initiative fostered our four PBL goals to improve their HIA papers. Also, a few students who attended community group meetings during the semester were prompted to continue their community involvement, where one student worked as a survey collector within this community and another student continued attending community group meetings to learn about the connection between community environments and health issues. One of these students pursued a master's in public health in health policy, where he was involved in local food systems research and recently graduated.

Reflecting on this assignment we learned several lessons that allowed us to make changes for subsequent courses. First, we learned the importance of allowing students to determine a topic that better aligned with their interests in order to make the assignment more motivating and acceptable to the individual. We limited our topic choices for future HIA papers as not to become too overwhelmed with grading multiple unknown topics. We choose food insecurity, childhood obesity, and/or the health implications of legalized recreational marijuana. Second, we clarified the paper by asking students to consider at least one policy, program, or law as the reason for doing the HIA paper. We then gave students an example policy to consider in one of the guest lectures. We also decided to require a research question, hypothesis, or at least one goal/purpose statement regarding the possible health impacts of the policy, etc. on two social groups. These requirements helped guide students in completing the rest of the paper, as they addressed their research question, hypothesis, or goal in the group and individual sections. Fourth, other curriculum improvements for our HIA paper included: clarifying the group vs. individual paper sections and work for students; making the group half due 4-6 weeks prior to the end of the semester for students to get faculty feedback and improve their grade prior to the final paper's due date; adding a rubric checklist and discussing the sections of the paper more often in lectures and earlier in the semester; clarifying the policy brief instructions and adding examples on our electronic course platform; and adding a guest speaker who was involved in a HIA. These efforts align with the additional support needed from faculty for PBL in the literature. Fifth, we realized that some international students had difficulties with the course and assignment. One international student said the course was difficult for her because even though it is an introduction course to U.S. Health Policy, she did not understand the historical contexts or examples we discussed in class and wondered when she would use this information. However, she was grateful for the HIA paper because she could see a use for this type of analysis once she returns to her home country. To ease these difficulties, we offered students time during faculty and teaching assistant office hours to help with their learning.

Finally, as a larger benefit to undergraduate public health students, we were able to counter a negative perception that public health is depressing because it focuses on health problems. Our HIA paper focused on solutions and was inspiring for students' future careers in public health. Through these student achievements, the assignment demonstrated intrinsic meaning associated with PBL.

Strengths of this research included: achieving PBL goals by using mixed methods with multiple data sources to address our research question, on-going monitoring of students' HIA paper understanding, and students' career development. We added to the few publications focused on PBL in undergraduate public health education on health policy (Byrd et al., 2012; Hearne, 2008). Based on students' survey and qualitative responses, we were able to achieve the PBL goals of acquisition, retention, and use of knowledge; problem-solving skills, communication skills, and cultural, legal, and ethical aspects of health and healthcare as applied to community engagement and food insecurity through the HIA paper. By the time students turned in their HIA papers, most responded positively about their learning from the assignment. Monitoring the HIA paper process during the semester possibly improved students' post-test and HIA paper reflections by the end of the course. This assignment also fostered career development opportunities for at least two students.

Some challenges with this research included our teaching this course for the first time, where we had no prior student feedback on our assignment clarity or the course readings, which could impact students' perceptions of learning. First, many students were confused about the assignment instructions and had difficulty thinking about social determinants of health applied to health policy. We believe these difficulties stemmed from many of our students previously being biology majors transitioning to public health, where there was some difficulty in changing their thinking from individual- to structural-level influences on health.

Second, some students may have positively biased their peer group member ratings because students generally chose their own groups and worked with friends. Moreover, students may have positively biased the ratings because they were not anonymous to faculty, since we monitored groups for their cohesion and work capacity. Third, more than three-fourths of our students were working full- or part-time and taking courses. Juggling work and school probably added frustration about the time commitment required to be successful in the course. But, in public health, which is a professional degree, students should be required to gain experiential learning despite some resistance (Riegelman & Albertine, 2011). Finally, we chose to quantitatively assess perceived student learning in two surveys by comparing student learning questions as our dependent variables to the remaining survey questions. The use of questionnaires can raise concern regarding external validity (Mamede et al., 2006).

For readers considering a similar community-engaged PBL assignment, we recommend a number of points. First, give students 2-3 choices for their assignment topic. Second, advise students to keep a journal on their individual, small group, and community service experiences. Make the journal part of their grade for the assignment, to help track all they do for the various components of the paper, including: course concept application, community lectures and interactions, group and individual work, and their reflections/thoughts on these things. The journals are a good way to stay organized throughout the paper and keep track of their positive learning experiences and challenges for the paper reflections. Third, provide more socio-demographic, historical, and policy background context for the topics through course readings, lectures, and guest speakers from the community. Also, prior to guest lectures, discuss with community members and agree on what is expectated for student deliverables. Then, have community members talk about student deliverables during their guest lectures. Fourth, we emphasize providing multiple, in-class preparatory steps (e.g., in the syllabus, lectures, handouts/electronic platform postings, and on-going in-class discussions) for students to work on the assignment individually and in small groups. We would even suggest using a "flipped" classroom some days to give greater emphasis on community engagement and group work during class time. Finally, we included our revised HIA paper, the rubric checklist, and HIA paper small group guidance in the Appendix to use or modify.

CONCLUSION

Overall, most students had a positive experience with our guest lectures, working in peer groups, and learning about food insecurity and the policy process for this assignment. In the students' words, they noted that doing a PBL assignment, particularly with guest speakers and group work, added more to their learning about the positives and negatives of health policy making.

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APPENDIX

Health Impact Assessment (HIA) Paper

Goal: This problem-based, learning assignment will be an opportunity to develop students' scholarship through research, professional networking, and service to the community, contributing to policy solutions. By encouraging innovative learning, we hope students will gain the ability to combine their theoretical knowledge of textbook concepts with real-world experiences in class discussions and research.

Background: A HIA is a support tool for policy-makers to address potential health impacts, to improve health and reduce adverse outcomes, and assess health inequalities in identified policies or programs (Metcalfe & Higgins, 2009). There are 6 steps in conducting a HIA: 1) *Screening* (identify projects or policies for which a HIA would be useful); 2) *Scoping* (identify which health effects to consider); 3) *Assessing risks and benefits* (identify which people may be affected and how they may be affected); 4) *Developing recommendations* (suggest evidence-based research and changes to policy-makers and community leaders to promote positive or mitigate adverse health effects); 5) *Reporting* (present the results to policy-makers and community leaders); and 6) *Evaluating* (determine the effect of the HIA on policy-makers' decision processes) (CDC, 2010). A HIA will assist students with applied learning for their undergraduate Public Health degrees.

The first HIA topic option: We identified X Neighborhood and deficits in food access and nutrition based on information from *Taking Neighborhood Health to Heart (TNH2H)*, a community-academic partnership located in neighborhoods in and around the former Stapleton airport, now among the largest redevelopments in the United States. TNH2H focuses on learning about and improving the health and well-being of people living in partner neighborhoods in the Denver metropolitan area. TNH2H has a well-established connection with these communities based on a prior grant from the National Heart, Lung, and Blood Institute to Dr. Deborah Main, the principal investigator of this grant. Students may examine the topic of food deserts in the Denver metro area or Colorado.

The second HIA topic option: Within the neighborhoods associated with the TNH2H group, there is an effort by community members to open school playgrounds during afterschool weekday hours and weekends to promote physical activity and reduce childhood obesity. Students may examine the pros and cons of this type of effort to change policy (whether it has happened or was petitioned previously in the Denver Public School system), the paths that neighborhoods need to take to make these policy changes, the stakeholders they should involve, and any possible barriers or problems that may come up as neighborhoods or communities pursue these policy changes. Students may choose a city in the Denver metro area to focus on, particularly examining policies at elementary schools within that city.

The third HIA topic option: Given the new amendment to Article XVIII of the Colorado constitution declaring that the use of marijuana is legal for persons twenty-one years of age and older and taxed and regulated in a manner similar to alcohol, students may examine the potential health impacts (positive and negative) of passing this legislation that became law on January 1, 2014. Students may consider examining children or adults in various contexts for the law's implications on their health outcomes, such as evidence gathered from schools, neighborhood associations, community health centers, hospitals, local professional societies (such as Multiple Sclerosis, where marijuana has been therapeutic for patients' pain), etc. Additionally, students may consider comparisons between other states or cities with similar marijuana laws and what health impacts have occurred since changes in the law.

Assignment: Individually and in small groups, students will collect and analyze data for their course assignment to find the most promising policy intervention to address food access difficulties (often related to chronic diseases and health disparities) or school playground access to promote physical activity and reduce childhood obesity. Examples of ideas, using the first topic as an example, are given below.

Each student small group will focus on the first three of the six steps in conducting an HIA, including:

- *Screening*. Students will examine current policies or initiatives by local government and community leaders focused on Denver and issues related to food access (sources: data from local government websites, such as the Colorado Department of Public Health and Environment, newspapers, or community associations for interviews).
- *Scoping*. The health effects students may consider include: nutritional intake based on the Department of Agricultures' food pyramid, infectious diseases, obesity, chronic diseases, and access to care. Students will conduct research on the impact of urban food deserts and poor nutrition on health, particularly affecting lower SES, racial and ethnic minorities, and older adults. Students may use websites, reports, and/or interviews from the following sources: the Department of Agriculture, Live Well Colorado, the Piton Foundation (2004), etc.
- *Assessing risks and benefits* (i.e., evidence is gathered on the effects of the policy or program on health determinants and health outcomes). Students will analyze beneficial and adverse health effects; integrate stakeholder input into the analysis of health effects; and describe data sources and methods. As a reminder, **make sure you use some data (qualitative or quantitative) and references to support your arguments.** Each sub-bullet represents a possible topic; chose one below:
    - *History and economics* of Denver's community and food access/food desert problems, particularly affecting lower SES, racial and ethnic minorities, and older adults (sources: community websites, newspapers, library archives, and interviews).
    - *Retail outlets*: what are their specifications/needs for potential retail sites; what are their perceptions of how adding a retail outlet will enhance the community and meet their needs; what are the contributions or deficits to the infrastructure of similar communities with recent retail outlet entries (sources: websites, newspapers, trade journals based on Lexis/Nexis

search, and interviews)?

- *Other built environment assessments*: drainage area difficulties exist at one site, where a possible community garden for neighborhood improvement is being discussed; other possible deterrents for retail outlets exist such as the impact of gangs, crime, abandoned buildings, etc. on the community; are light rail and bus systems adequate for transportation and connectedness to all parts of Denver? [sources: local city and state government and urban planning websites, Colorado School of Public Health (who has done research in the area for a possible community garden), community group meetings, and interviews]
- *Collect survey data* on people's perceptions of quality for the closest grocery stores, local food banks, and nutrition for the area (sources: consult with TNH2H and community meetings).
- *Older adults*: Are Denver's communities places where people can Age in Community [i.e. a grassroots movement of people coming together, addressing gaps in aging services and changing family dynamics, with the goal of keeping elders in their homes and connected to their communities; this movement offers the promise of including vulnerable groups and helping them stay within their communities via reciprocity of services among community members rather than always paying for external services (Blanchard & Thomas, 2009)]? Do older adults have a network of friends to get to stores? Do community groups or associations assist older adults in any way? (sources: consult with TNH2H, community meetings, and interviews).

Additionally, each student will be responsible for *Developing Recommendations*, *Reporting*, and *Evaluation* HIA sections as part of their individual assignment. Individual students will also:

- Maintain a journal of their individual, small group, and community service experiences, incorporating course concepts and reflections on their experiences. This journal will not be graded, but it will help with gathering information throughout the semester for your final HIA paper.
- Include an overview of your small groups' research for the first three HIA sections in your papers.
- Develop a *recommendations* section for policy-makers and community leaders, determining whether they will target Denver City Council or State legislators and what to include in their policy brief.
- Develop a *reporting* section that documents the population affected, the stakeholders engaged, data sources, methods, and findings, and recommendations. Include how you will communicate your findings and recommendations to decision-makers, the public, and stakeholders.
- Develop an *evaluation* section, based on comparative analyses of prior and similar legislation and/or voting patterns of policy-makers in Colorado. As part of this evaluation, students will identify and communicate any possible barriers to policy-makers implementing our HIA suggestions (Metcalfe & Higgins, 2009).
- Include a *reflections* section on their individual and small group experiences.
- Create a policy brief from your small groups' research findings.

Format: ~10 page paper (including your small group and individual section findings), typed, double-spaced, 12 point easy-to-read font, with 1" margins. Please be sure to use a consistent reference style for in-text citations and your full reference citations at the end of your paper, including books, journal articles, newspapers, websites, and interviews.

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HIA PAPER RUBRIC CHECKLIST

	Points
Small Group Section	**40**
Screening	**(12)**
• Describes at least 1 current policy	
Scoping	**(12)**
• Describes at least 2 adverse health effects [3 points]	
• Considers health effects in at least 2 social groups [3 points]	
• Describes research [HIA] questions & data sources [3 points]	
• Identifies alternatives to the proposed action to be assessed [3points]	
Assessing Risks & Benefits	**(12)**
• Describes baseline health of the population [3 points]	
• Describes benefits and adverse health effects of the proposal based on the categories listed in the syllabus (history and economy, retail outlets, built environment assessment, etc.) [9 pts]	
• (Includes at least 2 course concepts and/or includes 5 peer-reviewed journal articles)	**(4)**
Recommendations Describes a specific recommendation to identify actions to minimize harmful effects during the course of the HIA	**15**
Reporting Describes a specific plan [8 points] to communicate of findings and recommendations of an HIA to decision-makers, the public, and other stakeholders (these should be specifically listed/ identified as well – [7 points])	**15**
Evaluation and Monitoring Describes a specific plan to track and assess changes in health indicators as a new project or policy is implemented and applied over time [5 points] Compares previous or similar legislation [5 points] Discuss barriers to implementing your Recommendations [5 points]	**15**
Reflection	**5**
Policy Brief Follows typical / example format and language Title, key messages, report, options for addressing problem Or, define health problem, your "ask," and benefits of the policy (with community examples) Or, program description, background, policy intervention, research findings, & policy implications	**10**
TOTAL	**100**

HIA Paper Guidance for Small Group Work

1. Discuss and create an outline for your HIA group section of the paper, including screening, scoping, and assessing risks and benefits. Think about what's needed for each section of the paper. Think about what your individual strengths are and what you can contribute to the group. What do you specifically want to focus on under the topic of: 1) food deserts related to obesity and/or chronic diseases, 2) after school access to playgrounds related to physical activity and childhood obesity, or 3) marijuana legalized use and health.
    a. What literature search terms will you use?
    b. What databases will you use?
    c. What type of data, tables, and/or figures do you want to use? Consider using existing data from community group organizations, Denver Public Schools, local/county and state public health department websites, etc.
    d. Will you use all secondary data or do you want to collect primary data from interviews, surveys, focus groups, etc. Who/what professionals or community members could you talk with about your topic?
2. Decide who will do what research and writing to contribute to the paper. Assign tasks to complete for the next HIA group meeting and set a date for this meeting.
3. Your group may also decide on a set of solutions to your topic, where each group member could focus on one solution in his/her individual sections of the HIA paper.
4. Over the next few weeks, be prepared to do a peer and self-assessment survey for your group work on the HIA paper. This will help us understand if your groups are working effectively together or if some intervention is needed to better guide your group.