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Best Practices Using Clickers Effectively in an Introductory Programming Class

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Abstract

Active and peer learning techniques are proven to be effective teaching methods. One form of active learning that is particularly useful in large lecture-based classroom is the use of clickers. One form of peer learning is incorporating peer discussions into the clicker activity. This paper presents on best practices at designing clicker questions, facilitating clicker responses, and incorporating peer discussions for an introductory programming course. The course used in this study is for underclassmen mechanical engineering undergraduate students. The paper will present both quantitative and qualitative data that demonstrate effectiveness. Lastly, over 18 sample clicker questions are provided for engineering faculty to use directly, or by example.

Keywords: Engineering Education, Active Learning, Peer Learning, Clickers

Introduction and Literature Review

The use of clickers is just one of many active learning techniques that can be easily implemented into a class. The work presented in this paper is part of a course that was designed and ran for the first time in Spring of 2013. It is still running now in the Spring of 2017, which amounts to 7 semesters using the same course design and over 650 students taking the course. The course design and its effectiveness are described in detail in a previous paper (S. Reckinger, 2014), but a brief summary will be provided here. The sample student population is undergraduate Mechanical Engineering students. The primary course goal is for students to learn introductory programming concepts such as using loops and conditional statements, writing functions, and developing algorithms to solve problems using the MATLAB software. The programming is mainly applied to numerical methods, data analysis, and statistical concepts relevant to engineering. The course is taught in an engineering department by a mechanical engineering faculty member, who's research background is in computational fluid dynamics. The curriculum employs many of the active pedagogical approaches including a pseudo flipped classroom (Bergmann & Sams, 2012), Process-Oriented Guided Inquiry Learning (POGIL) method (Farrell, Moog, & Spencer, 1999), clicker questions, and kinesthetic lectures (Sivilotti & Pike, 2007). In addition, traditional techniques are still used such as an abbreviated, concise board lectures and hand-written exams. The course also incorporates peer learning through the use of undergraduate teaching assistants (similar to learning assistants or peer learning group leaders (Otero, Pollock, & Finkelstein, 2010) and partner quizzes (in addition to the peer learning that happens with the clicker methods presented here). A full description of the peer learning techniques can be found in a previous paper (S. Reckinger, 2016). One important note is that the instructor has taught this course at two different universities. The first is a private, Jesuit university in the Northeast (Spring 2013, Spring 2014, Spring 2015). The second is a public, land grant university in the West (Fall 2015, Spring 2016, Fall 2016, Spring 2017). Results will be mixed from different semesters.

The purpose of this paper is to discuss how to implement clickers effectively in an introductory programming course. First, the method of how to facilitate the class through the clicker process will be described. Second, the design of an effective clicker question will be discussed and 18 sample clicker questions are provided as examples. Quantitative results will be presented on student performance on clicker questions. Qualitative results will be provided to show and describe the learning that cannot be measured quantitatively. Students preferences and feedback regarding clicker questions will also be presented, which show students' affect towards the use of clickers in the classroom.

Methods

The facilitation of clicker questions is one of the two most important aspects of using clicker questions effectively. The procedure for using clickers is to provide a question for students to answer and ask them to first individually answer the question. After giving them enough time, the poll is closed and the distribution of answers is analyzed. If approximately 80% of the class or less has the correct answer, a discussion period follows. The instructor explains, "please discuss with your peers at your table (or nearby), come to a consensus on what is the best answer, and click in your answer to this question for a second time." After a few minutes of discussion, the instructor stops the poll again and looks at the results. This process takes substantially longer than just asking the question one time, which is why its effectiveness needs to be very evident to be worthwhile. Previous work has shown that conceptual understanding of material is enhanced when clickers incorporated peer discussion (Smith et al., 2009), which is the motivation for this process. The last point to make is that the clickers presented here are all used as review of material, which was just learned in the previous session or week. Before answering these clicker questions, students have had a full lecture on the material, completed a prelab assignment, and started and/or finished a programming lab. Therefore, this material is new but well-practiced. The clickers are graded for correctness and contribute to a participation grade, which makes up 10% of their final grade. An adequate grade incentive also improves effectiveness.

The design of the clicker questions is the second important piece. The author of this paper has presented this work on many occasions to engineering faculty teaching similar courses. One of the main purposes of this paper is to have sample clicker questions published so that they are available for engineering faculty to use directly or by example. There are 18 sample clicker questions provided in the Appendix of this paper for that reason. These questions are all written by the author of this paper or by Dr. Scott Reckinger, who helped with the Spring 2013 semester of the course. Syntax questions are particularly popular in peer discussions, see Questions 1-3 in the Appendix. The multiple-choice options need to be carefully designed to incorporate misconceptions or common errors. For example, in Question 2, students need to sort out when a dot operator (.) is to be used, what the colon operator does, that parentheses are used for array accessing, and the use of the asterisk for multiplication. Questions, like this, that request which answer would NOT work, are also particularly good at sparking robust discussions. Many of the questions (4, 6-10) are examples of reading and understanding simple codes. These are simple enough that students can figure them out by reading them, but the logic is tricky enough that they induce some intense and productive discussions. Questions 15-18 are examples of doing some computations by hand related the methods that are being programmed in the lab in a much more complex way. These questions are also very popular for discussions.

Lastly, the questions published here are all chosen because they have been used many times and always generate a lot of interesting discussion. However, these are not all the clicker questions used in the class. These published questions are a form of an "open" question. Not in the sense that they have multiple correct answers, they certainly all have a single correct answer. But in the sense that the answer does not close the discussion. These types of questions generate discussion. An example of a "closed" question would be: "What symbol is used for writing a comment in MATLAB? a) ; b)# c)$ d)%". This question can be categorized as closed because if a student is incorrect, the discussion is usually limited to a correction of knowledge on a very specific issue. These questions are useful, especially as warm up questions, but are not good for discussion.

Results

During an end of the semester survey, students were asked, "did you find that the clickers and clicker discussions with your peers helpful to your learning?" Out of all 89 students from both Spring 2014 and 2015 semesters, 60 students (67.42%) said "yes", 0 students said "no", and 21 students (23.60%) said "a little". Towards the end of the Spring 2015 semester, students were assigned seats. This actually greatly enhanced the already successful clicker peer discussions. Several students voiced their support of assigned seating and wished it was that way the entire semester.

Data was collected on the percentage of students answering clicker questions correctly before and after peer discussion. This data has been collected for each semester, when peer discussions were implemented, however, only Spring 2014 data is presented in Table 1 for conciseness. The same trend has been consistent in all semesters of teaching a wide variety of classes using this method. The table shows the percentage of students who answered the clicker question independently, before peer discussion (Independent Q#) and after peer discussion (Peer Q#). The difference between the two is also shown in the adjacent cell. This data is with students' self-selected seats, so they are typically discussing these questions with their peers. In all instances, the peer discussion results in more students arriving at or being convinced of the correct answer. One important note is that clicker questions are typically covering fairly new material, often times the material was introduced for the first time the previous session. Also, questions are only asked twice when there is not an obvious consensus among the class. While the data in Table 1 clearly demonstrates that peer discussions lead to more students clicking in the correct answer, it does not indicate how effective the discussions are at students' understanding of the content. The survey data presented above indicates that students feel that the peer discussions help with their learning.

	Percent of Students who answered correctly	**Difference between Peer Q# and Independent Q#**		**Percent of Students who answered correctly**	**Difference between Peer Q# and Independent Q#**
Independent Q1	29.4%		Independent Q10	70.3%	
Peer Q1	88.2%	58.8%	Peer Q10	97.1%	26.9%
Independent Q2	52.2%		Independent Q11	29.7%	
Peer Q2	78.3%	26.1%	Peer Q11	50.0%	20.3%
Independent Q3	31.6%		Independent Q12	22.9%	
Peer Q3	40.0%	8.4%	Peer Q12	48.6%	25.7%
Independent Q4	60.0%		Independent Q13	38.9%	
Peer Q4	100.0%	40.0%	Peer Q13	60.0%	21.1%
Independent Q5	66.7%		Independent Q14	37.1%	
Peer Q5	80.0%	13.3%	Peer Q14	86.4%	49.2%
Independent Q6	70.6%		Independent Q15	20.6%	
Peer Q6	85.7%	15.1%	Peer Q15	81.0%	60.4%
Independent Q7	39.4%		Independent Q16	39.4%	
Peer Q7	69.4%	30.1%	Peer Q16	79.4%	40.0%
Independent Q8	29.7%		Independent Q17	54.5%	
Peer Q8	43.2%	13.5%	Peer Q17	100.0%	45.5%
Independent Q9	73.3%		**Independent Mean**	**45.1%**	
Peer Q9	92.9%	19.5%	**Peer Mean**	**75.3%**	**30.2%**

Table 1 – Summary of clicker question responses for questions that were asked first as an independent response (Independent Q#) and a second time after students discussed the answer with their peers (Peer Q#). These question numbers to not correspond to Appendix questions.

Peer discussion can be so effective that a group of students who all clicked in incorrectly individually can click in correctly after discussing. The author of this paper has witnessed this in upper division courses, but does not yet have clear evidence of this happening in this introductory class. In a junior thermodynamics course taught by the author, the large majority of students clicked in a wrong answer on a particularly difficult conceptual question. However, after peer discussion, the majority of the class had come to consensus on the correct answer. Showing that it is the discussion that improving learning, not just a simple sharing of the correct answer. In the Appendix, Question 2 has shown similar results, but not as strong (see Table 2). In the Fall of 2016, the majority of the class clicked in the wrong answer after answering individually. After peer discussion, the percent of students clicking in correctly went from 12% to 32%. However, when the same question was asked in Spring 2017, the percentage of students clicking in correctly went down after discussion. This means, some students who originally clicked in correctly were convinced of the wrong answer by their peers. This is the first time the author has witnessed this happening.

	Fall 2016		**Spring 2017**	
	Independent	**After discussion**	**Independent**	**After Discussion**
A	101 (78%)	78 (63%)	68 (72%)	81 (90%)
B	**16 (12%)**	**40 (32%)**	**12 (13%)**	**8 (9%)**
C	12 (9%)	5 (4%)	10 (11%)	1 (1%)
D	0 (0%)	1 (1%)	4 (4%)	0 (0%)

Table 2 - Table of responses to Question 4 in Appendix. The color red highlights the correct answer.

To supplement the quantitative data provided above, a qualitative discussion will follow. Figure 1 shows some images of a class answering a clicker question using the process outlined above. A video would be much more convincing, but not possible for this publication. The first image shows students answering the clicker question independently. The author of this paper is currently investigating how learning styles can affect different teaching and assessment techniques used in engineering education (S. M. Reckinger & Hughes, 2017 (in press)). One interesting learning style dimension relevant to clicker discussions in the active/reflective scale. Active learners learn best when doing, trying, discussing, and moving. Reflective learners learn best when thinking, independent, and in calm/quiet environments. This individual response in particularly useful for reflective learners. It allows them to think through the question on their own before being required to discuss with their neighbors. This response period is generally very quiet and “exam-like”. After responses are collected and analyzed by the instructor, students begin the discussion period. During this time, the room becomes very loud. There is a lot of pointing and air drawing. See the middle photo in Figure 1. Observationally, the discussions are typically enthusiastic and engaging. It is fun to see students discussing their opinions on the question with convection. Active learners find this particularly necessary and they are especially engaged in the discussions. They click in their answers for a second time (receiving credit for both their individual and peer discussion answers). Since students and their surrounding peers are invested in their answers, at this point, there is typically loud groans or hopefully, celebratory high fives and cheers once they find out the correct answer, as see in the third photo of Figure 1.

Figure 1 – Three images of a lecture class where students are answering clicker questions using the process described in this paper.

The instructor has observed the following type of student engagement during these clicker activities. First, there is the disengaged students. These students do no participate in the discussions or do not take the initiative to turn in, turn around, or find another person to chat with. They may benefit from listening to others discuss around them or may not benefit at all from these discussions. Due to the grade incentive, there are not many of these students. Second, there is the flex student. Flex students will engage in discussion if someone else addresses them. They may limit the discussion as much as possible ("yeah, I put that too. Cool, let's click that again.") or may engage if it occurs naturally. Third, there is the reflective discusser. These are students who would normally be rather introverted/quiet/independent, but when given the adequate prep and environment, they become quite active discussers. They typically understand the questions and answers well and will take the opportunity to explain to others who don't, which also benefits their own understanding by forcing them to explain their rationale to someone else. Fourth, there is the active discusser. This person is also very engaged in discussion but takes the discussion period as an opportunity to "talk it out". They need that discussion period to hash out their thoughts, and benefit greatly from some back and forth. Finally, there is the asker. There is also a large group of students who take this opportunity to ask their peers questions: "what did you put?", "what does this mean?", "why doesn't this one work?" These students are great contributors to the discussions. And they pair very well the with the previous two types.

Discussion

The peer discussions after in class clicker questions are incredibly effective and an easy peer learning technique to implement. Students found these helpful and clicker response data also shows their effectiveness. There is evidence that the discussion improves learning and do not simply communicate the correct answer from peer to peer.

Overall, the course is progressing to a successful learning environment for most students. With the careful course design and the addition of peer learning techniques, most data indicates that the course is effective. Pre and post test scores indicate not only that students are developing the desired skills that the course sets out to teach, but also that students are leaving the course knowing more than when they started. Course evaluations show an increase each semester in student's overall evaluations of course learning outcomes achieves, the course overall, and the instructor overall. Students reported a positive affect towards programming once they leave the course, which is a very important result. This could be the single most important result of this course.

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Appendix

1. Given the following array, bear=[3 4 5 8 1 0] defined in MATLAB. How do you access the value 4 inside the array?

a) bear[2]
b) bear[4]
c) bear(2)
d) bear(4)

2. How to convert degrees=[10 15 70 90] into radians using MATLAB...which one of the codes below would NOT work?

a) radians=degrees.*pi./180
b) radians=degrees*(pi/180)
c) radians=degrees.*(pi/180)
d) radians=degrees(pi/180)
e) radians=degrees(:)*pi/180

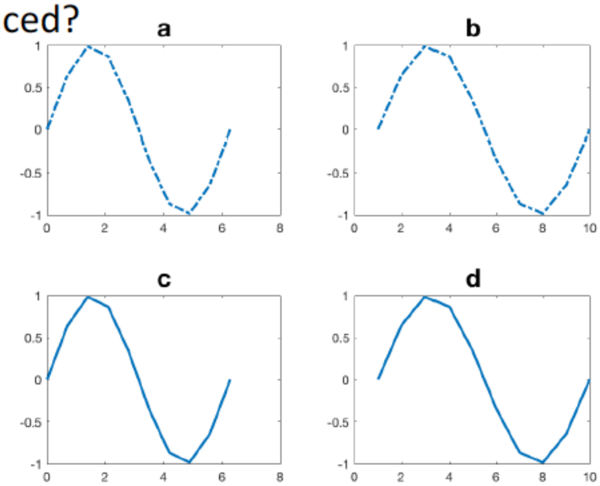
3. If you want to create data for the following function (over the range x=[0:0.1:1]):
$f(x)=x^2+2$
Which of the following MATLAB definitions is correct?

a) $f(x)=x^2+2$
b) f(x)=x^2+2
c) f=x^2+2
d) f=x.^2+2
e) f=x.^2 .+2

4. If you execute the following commands in MATLAB:

```
x=[0:2*pi/9:2*pi];
y=sin(x);
plot(y, '-.')
```

Which plot is produced?



5. For the array, **`p=[2,-1,5,8,-9]`**, what does **`m`** equal after the following command is executed:

`m=p<2`

a) Error, does not run
b) m=[-1, -9]
c) m=[2, 5]
d) m=[0, 1, 0, 0, 1]

6. Follow the code's logic and report what will be displayed:

```
cat=5;
if (cat<=5)
  dog=0;
elseif (cat>5)
  dog=1;
else
  dog=nan;
end
dog
```

a) cat=5
b) cat=0
c) dog=0
d) dog=1
e) dog=nan

7. While Loops – which of the following codes will result in an infinite loop:

a.

```
count=1;
while count<3
  r(count)=5;
  count=count+1;
end
```

b.

```
count=1;
while count<3
  r(count)=5;
end
```

8. Follow the code's logic, what will be the value of count after all the code is executed?

```
count=0;
weights=[100 44 75 80 99];
for i=1:5
   if weights(i)<50
      count=count+1;
   end
end
```

a) count=0
b) count=1
c) count=2
d) count=3
e) count=4

9. What value will `iter` have at the end of the following section of code?

```
x=[100 115 131 154 186 203 242 256];
myvalue=203;
iter=1;
while myvalue>x(iter+1)
    iter=iter+1;
end
```

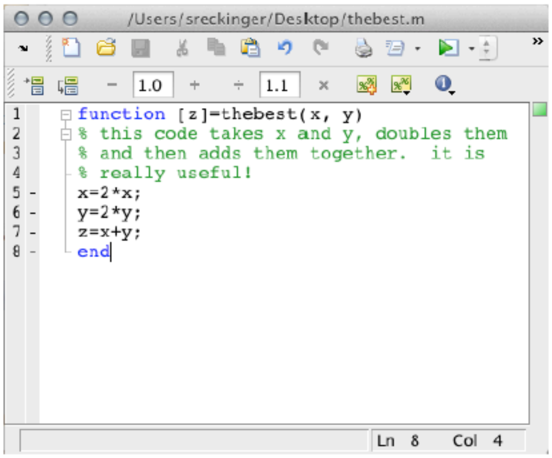
a) Code won't run
b) 1
c) 3
d) 5
e) None of the above

10. How many times will "I LOVE MATLAB" be displayed when the following code is run?

```
for i=1:10
    for j=1:8
        if i>2 & j>2
            disp('I LOVE MATLAB')
        end
    end
end
```

a) 80 b) 10 c) 8 d) 5
e) none of the above

11. Assuming you write the following function in an m-file. How do you run the function with x=1 and y=2 (i.e. which one would run without error)?



a) >>thebest
b) >>thebest(12)
c) >>thebest{1 2}
d) >>[z12]=thebest[1, 2]
e) >>thebest(1,2)

12. You wrote this function:

```
function [result, result2]=myfunc(x,y)
    result=x.*y+4;
    result2=1;
end
```

If I type myfunc(1, 1) in the command window to run this function, what will be printed to the screen?

a) Nothing
b) 5, 1
c) 1
d) 5
e) An error

13. You wrote this function:

```
function [result]=myfunc(x,y)
    result=x.*y+4;
end
```

Which of the following is an invalid way to call your function?

a) `x=1; y=2; result=myfunc(x,y)`
b) `A=1; B=2; AtimesBplus4=myfunc(A,B)`
c) `myfunc(1,2)`
d) `answer=myfunc`
e) `irrationals=myfunc(pi,sqrt(2))`

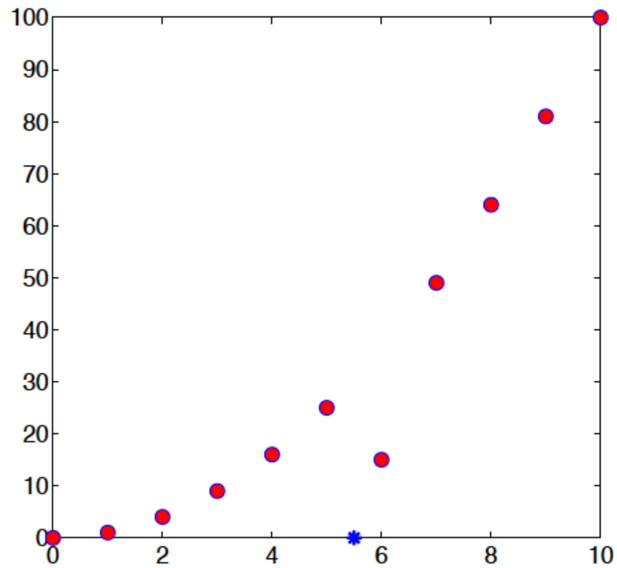
14. What value will `iter` have at the end of the following section of code?

```
a=[-2 0 3 5 6 6 7 8 9 10];
iter=0;
for i=1:length(a)
    if a(i)>5
        iter=iter+1;
    elseif a(i)<5
        iter=iter-1;
    end
end
```

a) 0   b) 3   c) 5   d) 6   e) 10

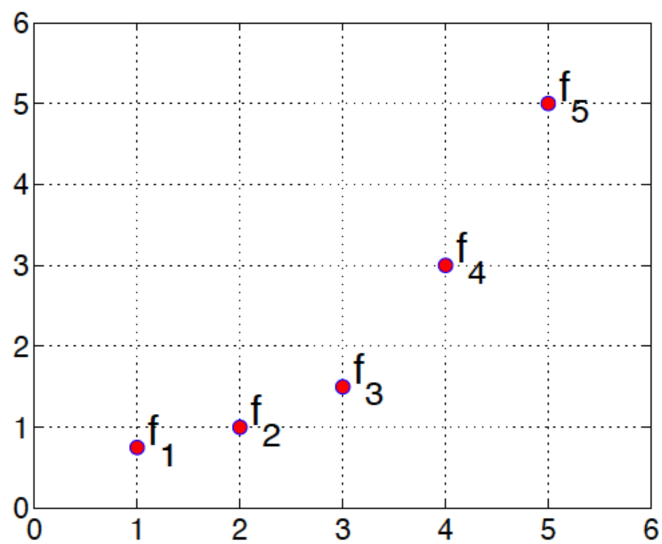
15. What is the linearly interpolated y* value for x*=5.5?

a) 10
b) 20
c) 30
d) 40
e) 50



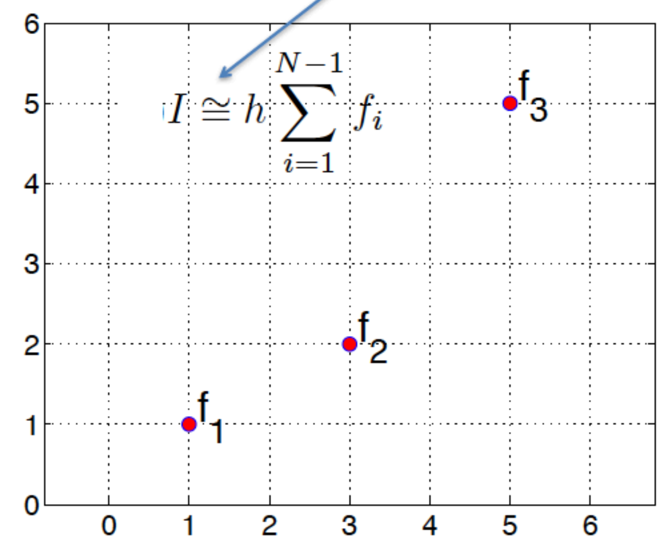
16. What is the numerical derivative f_3' using central finite differentiation?

a) -1
b) 0
c) 0.5
d) 1
e) 1.5



17. What is the numerical integral, from x=1 to x=5, using the rectangular rule?

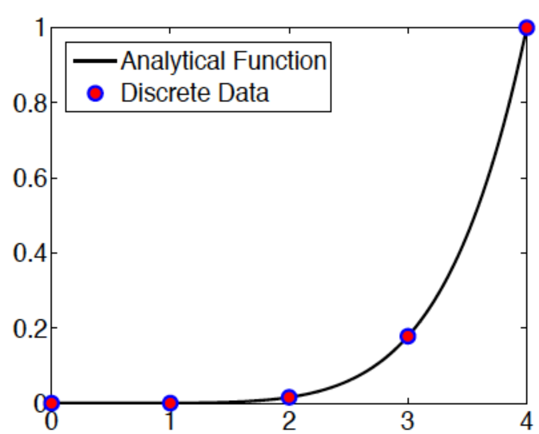
a) 20
b) 3
c) 15
d) 5
e) 6



18. What is the order least to greatest?

I_{exact} = exact integral of analytical function
I_{trap} = approximate integral using trapezoidal rule
I_{rect} = approximate integral using rectangle rule (left)

a) $I_{exact} < I_{rect} < I_{trap}$
b) $I_{trap} < I_{exact} < I_{rect}$
c) $I_{rect} < I_{exact} < I_{trap}$
d) $I_{trap} < I_{rect} < I_{exact}$
e) $I_{rect} < I_{trap} < I_{exact}$



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Closing the Gaps: Guiding Students to Take Notice, Take Charge, and Graduate

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Abstract

College and university administrators continue to explore ways to decrease time to graduation and eliminate opportunity and achievement gaps among their students. The purpose of this study was to gather student perceptions of the availability and quality of academic resources on campus as a means to explore ways to improve graduation rates and decrease inequities. Undergraduate student focus groups provided qualitative data on student perceptions of helpful and less helpful campus resources. Students also shared lessons learned from experiences they gathered while navigating higher education. The study's findings are discussed and suggestions for developing a welcoming campus culture that promotes student success accountability, sense of belonging, and a seamless advising culture are offered.

Keywords: Student Success, Advising Practices, Sense of Belonging, Opportunity Gap, Campus Culture

Introduction

Equitable college completion rates among underrepresented and non-underrepresented students have improved but graduation gaps continue to pose challenges in higher education (Eberle-Sudre, Welch, & Nichols, 2015). While strides have been made towards college persistence, in some cases, the overall achievement gap remains. The graduation gap has widened for African American students in particular (Nichols, Eberle-Sudre, & Welch, 2016). This inequity can be attributed to a number of factors. First generation students who are often simultaneously learning how to survive and succeed in higher education need seamless support structures that don't require students to know exactly what help they need and when they need it in order to receive support (Hausmann, Ye, Schofield, & Woods, (2009). Underrepresented students also often need guidance with finding ways to become involved (Bergen-Cico, & Viscomi, 2013). Increasing completion rates and eliminating achievement gaps, require opportunity gaps and equity gaps to be acknowledged and addressed (Harper, 2015). This can be achieved in a number of ways. First, administrators must ensure that students acquire a sense of belonging on the campus by assuming responsibility for awareness of and engagement with students (Strayhorn, 2012). Next, campus advisors and student resource providers must ensure encompassing support by finding ways to collaboratively offer strategically aligned and seamless advising and services. Finally, administrators, advisors, and faculty alike must recognize the need for timely and proactive student advising and outreach through early alert initiatives (Jayaprakash, Moody, Lauria, Regan, & Baron, 2014).

Sense of Belonging

According to Strayhorn (2012, 2014) and Maslow (1943), "sense of belonging" is a basic human need. The concept of belonging is the perceived level of connectedness as a member of the campus community and culture. It is the feeling of social support and "that one is important to others, that one matters" (Strayhorn, 2012, p. 31). Sense of belonging is an asset-based perspective held among engaged students about their individual importance to the campus culture (Quaye & Harper, 2014); it is relational and reciprocal. A solid sense of belonging is essential for academic success among marginalized groups. Faculty and administrators must be intentional in ensuring students feel acknowledged, respected, and involved within the campus culture (Arminio, Torres & Pope, 2012). This connection guides students towards having a successful academic experience and making progress towards degree completion.

Seamless Support

Seamless advising speaks to the importance of an alliance among campus resource providers, academic advisors, faculty, and staff in institutions of higher education as they guide students towards successful degree completion. These personalized interventions increase the frequency with which students receive help and may improve graduation and retention rates (Bosco, 2012; Capaldi, Lombardi, & Yellen, 2006).

Early Alert Advising

Proactive, student-centered communication between students, faculty, and academic advisers, is essential to the persistence and success of many struggling students. (Bergerson, Hotchkins, & Furse, 2014). Reasons for experiencing difficulty or being put at educational risk can vary from academic, social, financial or personal challenges (Swecker, Fifolt, & Searby, 2013). Early alert interventions usually include historical and real-time data, metrics, and preemptive communications to prevent adverse and otherwise imminent consequences (Cai, Lewis, & Higdon, 2015). Early alert advising should be supportive, not punitive, and provide enough lead-time for corrective action, not irreversible consequences.

Methodology

Undergraduate students at a large, public Hispanic Serving Institution (HSI) in southern California were invited to participate in a focus group to discuss their perceptions of the availability and quality of student resources on the campus. A faculty member from the Psychology and Sociology Department trained upper division psychology students to conduct student-led focus groups. Researchers conducted 13 student-led focus groups during spring of 2015. Most of the focus groups occurred during the students' "open" hour and lunch was provided. Each focus group lasted about 45 minutes. Sixty-six undergraduate students participated in the focus groups. Participants signed consent forms and were informed of the confidentiality of their individual input. Following the signing of consent forms, the researchers departed and the trained student facilitators presented guiding questions that asked about campus resource successes, barriers, and lessons learned.

The research team analyzed the transcribed results using LeCompte's Thematic Analysis (LeCompte, 2000). Several themes on student-perceived helpful and less helpful programs, forms, resources, advising, and lessons learned emerged from the focus groups. Barriers to completion and information that students wished they had access to earlier than they did in their academic careers were also discussed.

Findings

Several themes emerged from the responses to the guiding questions provided in the focus groups. Students held perceptions regarding a number of helpful campus resources including support programs, advising centers, and peer mentoring. They also had assertions about what considered hindrances and roadblocks.

Helpful Campus Resources

Participants were asked about their awareness of campus resources and their perceptions of those resources. Students acknowledged several support programs, for both general and targeted group access, as particularly helpful. They also found various advising options, particularly peer mentors, as helpful and even preferable.

Support Programs

Students believed many student-facing support programs had immediate and obvious benefit. Particularly, students mentioned the Educational Opportunity Program (EOP), an access and equity support program for marginalized students. Students lauded the targeted support provided honors students and the advising support that is provided to students who arrive to campus without having a major declared. They appreciated the extra perks provided to students who participate in the Two- and Four-Year Pledge programs such as early registration and added advising, and the ongoing support offered by the various summer bridge programs.

Advising and Peer Mentors

Students in the focus groups appreciated having the new college-based advising centers available to them. Participants spoke favorably of academic support programs such as group advising and peer mentors. Peer mentor resources are decentralized and often reside within various programs, colleges, and organizations. With regard to peer mentors, students whose college offered that type of resources responded favorably, while students whose college did not offer the option desired to have access to peer mentors. Students who served as peer mentors stated that they learned more about available campus resources once they became peer mentors than they knew at the time they needed those services themselves.

Participants also shared appreciation for the various self-support tools that were made available to them. Tools included interactive online roadmaps, up-to-date lists of course offerings for two years at a time, and more accurate degree progress reports (DPRs), which updates their classification, informs their standing, and determines their registration priority. Transfer students frequently touted an online tool specifically for them that helps them keep track of units taken and needed to successfully complete their program.

Less Helpful Campus Resources

Students shared perceptions of campus resources that they found less helpful than others. Lengthy orientation sessions, bureaucracy, and other barriers to completion were discussed. Participants regarded these often well-intended resources as hindrances to graduation that should be revisited and reconsidered.

<u>Lengthy Orientation Sessions</u>

There were some resources that administrators intended to be helpful that students considered less helpful than anticipated. Students often cited the required three-day orientation as too long, with too much information, and too rushed. Students also reported that the orientation groups were too large and they felt dissuaded from engaging with their new peer mentors or advisors during that time.

<u>Bureaucracy</u>

Some students provided anecdotes about being offered inconsistent information or different information from that of a peer in another college. Students reported having to visit several offices or campus locations to arrive at an answer or resolution. Participants also reported feelings of being burdensome when they visited some of the larger support offices on campus.

<u>Barriers to Completion</u>

A number of students voiced concerns about barriers to completion. Most concerns involved course offerings. Participants reported not being able to enroll in the courses that they needed because many of those courses were being taught on the same day or at the same time or not enough sections of the course were offered. Some courses were offered only once per year without being advertised as such. In other cases, students found courses that they expected would be offered were not offered because the department had not updated the two-year course offerings list. Students reported that these delays impacted their schedules significantly and postponed their original graduation date.

Lessons Learned

The topics that students most considered learned lessons were related to understanding how to create a balanced course roadmap for their program plans and expectations for advising.

Most students reported not understanding or realizing that not all courses in their plan of study are offered every term; some upper-division courses are offered once an academic year and so strategic planning for course enrollment is a must. Participants also stated that receiving reliable advising early in their college career to help build a balanced program roadmap that included built-in flexibility would have helped them avoid taking unneeded courses and better maximize the academic year. Many students confessed that they learned how to mix major and general elective courses to create a balanced schedule later than they would have liked and productive visits with an effective advisor could have helped with understanding that earlier. Students also realized that enrolling in only the minimum number of units necessary to receive financial aid inevitably delayed their degree completion.

Overall, students requested a central advising area for all majors where they can ask questions and receive clear, consistent advice about roadmap planning and preparing for graduation. Participants stated a need for easy to use guides and online tools for roadmap planning and reliable lists of two-year courses offerings so they can accurately plan and create realistic roadmaps for their college career. They also requested welcoming attitudes from advisors rather than feeling like a burden when requesting help at some of the larger resource centers.

Discussion and Suggestions

Promoting student success is the responsibility of all campus constituents (Arminio, Torres & Pope, 2012). Hansen (2014) asserts, "peers, faculty, advisors, staff, and administrators play a role in developing an institutional context that facilitates academic hope among students" (p. 18). It involves not only early advising interactions that are positive experiences for the students, but the results of those interactions must help students gain clarity in understanding how to navigate and be successful on the college campus. From an administrative perspective, this means creating a campus culture that is welcoming, accepting, and respectful (Strayhorn, 2012) and developing an advising culture that is ongoing and beneficial to students (Swecker, Fifolt, & Searby, 2013). Establishing these cultures are not easy tasks; campus leadership must resolve to be disrupters of what has always been and recognize and accept that the changes in customary practices are going to cause discomfort for some members of the campus community who are not ready for change (Arminio, Torres & Pope, 2012; Quaye & Harper, 2014; Strayhorn, 2012; Wheatley, 2005). Campus leadership must commit to instituting accountability, sense of belonging, and early alerts as integral parts of seamless advising to actively support student success.

Accountability

In order to establish student success accountability, campus leaders must determine up front what success means. This means setting goals early in the disruption process, ensuring the goals are measurable and systematically measured, and ensuring that those data are correlated to or representative of the intended goals. The data also needs to be revisited often and shared widely to gauge affect of the changes. These suggestions are in keeping with Andrade (2011), who offers that developing effective assessment systems promote accountability and transparency and help intuitions clarify purpose and re-evaluate goals.

Sense of Belonging

Developing a sense of belonging among students, particularly those who are marginalized requires commitment from administrators, faculty, and staff. Student engagement has a direct effect on retention (Bergen-Cico, & Viscomi, 2013) and the onus of student engagement rests on the institution (Quaye & Harper, 2014). Administrators must adopt techniques for providing faculty, and staff with tools to support diverse students while critically engaging majority populations (Harper, 2015). Helping students find their academic identities within the campus contributes to their sense of belonging (Bergerson, Hotchkins, Furse, 2014). These approaches will require open and honest dialog (Arminio, Torres & Pope, 2012; Quaye & Harper 2014), and attention to intentionality. Institutions with less diverse student populations must make strides towards implementing a culture of diversity inclusion (Wade-Golden, & Matlock, 2010; Zepeda, 2010). Discourse should include expectations of acceptance rather than tolerance, inclusion rather than assimilation, and respect rather than acclimation.

Early Alerts

Early alert advising is the process of identifying specific barriers to student success based on certain criteria, reaching out to students who meet those criteria, and providing support to assist students with addressing those challenges to change their trajectory. Early alerts offer opportunities for intervention and should be supportive and student-centered. Farnum, (n.d.) concurs and stresses that early alerts should not be portrayed as punitive or insurmountable.

According to the feedback received from the student focus groups, students on campus desired early alert outreach communications to help them stay on schedule towards graduation. Examples of institutionalized early alerts include informal email reminders to students who have not taken the first math course for their major by the end of their first year and notifications prior to registration when a required upper division course for their major is offered only once a year. All student communications also would include an invitation to make an appointment to meet with one of their advisors, along with contact information for their advisors, and a link to the campus-wide e-advising tool. To promote the success of early alert advising, administrators, faculty and staff should identify an accountable point of contact, provide clear steps for resolving the early alert issue, and create effective lines of communication among resources so students are not misdirected. This is in keeping with Farnum (n.d.) and Cai, Lewis, and Higdon (2015) who recommend multiple points of contact and support across divisions for early alert advising.

Conclusion

The purpose of this study was to learn more about student perceptions of the academic resources on campus in efforts to close opportunity gaps among student groups. The findings suggest that students respond best to the resources that are targeted to their needs and that offer continuity. Closing opportunity gaps among students on a college campus will involve deliberate efforts on the part of administrators, faculty, staff, and students. Administrators can lead the charge of disrupting the status quo and implant new cultural norms by insisting on accountability among campus teams; fostering a campus-wide sense of belonging for marginalized students; and promoting effective seamless advising that includes, support programs, advising and peer-mentoring, and student-centered early alerts.

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