Sequential-Choice Random Allocation: An Efficient Process for Matching Students to Mentorships, Job Shadowing and other Short-term Experiential Opportunities

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Purpose of the Study: Resource allocation is more than the matching of two objects, but a systematic and efficient pairing process. Some experiential learning activities, like job-shadow assignments may create matching problems that can be solved with efficient allocation mechanisms. This research describes and evaluates a novel unilateral allocation method developed to efficiently match students with companies.

Method/Design and Sample: Using repeated measures ANOVA, this study compares the effects of three allocation methods (Resume-Exchange, Complete Randomization, and the proposed Sequential-Choice Random Allocation) used to match sales students and university sales program sponsors for job-shadowing.

Results: Students rated Sequential-Choice Random Allocation higher on satisfaction and the same method also produced a greater proportion of students receiving their first, second, and third choice preferences.

Value to Marketing Educators: This research provides educators with a fast and efficient allocation technique to match students with experiential learning activities, especially when employer preferences are not required.

Keywords: experiential learning, job-shadowing, resource allocation, allocation method, match efficiency

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INTRODUCTION

The value of experiential learning is universally recognized as a means of enhancing traditional classroom instruction (Mantel, Pullins, Reid, & Buehrer, 2002). Experiential activities lead to deeper learning for students when compared to more traditional classroom approaches like lectures and tests (Mader, Mader, & Alexander, 2017; McCarthy & McCarthy, 2006; Wurdinger & Allison, 2017). Faculty and administrators therefore develop and incorporate various kinds of experiential activities in and out of the classroom like class projects (Chapman, Schetzsle, Wahlers, 2016), apprenticeships, mentorships (Burnett & Pettijohn, 1999), externships and internships (Gault, Redington, Schlager, 2000; Weible, 2009). According to Weible (2009), internship opportunities of some kind are offered by 94% of business schools. Gaining valuable, practical work experience in a supervised environment has long been accepted as an effective means of transferring knowledge and skill for specific trades (Coco, 2000). Depending on the activity, university, or employer, students may be required to either partner with a business on their own accord or be matched to a principal—or employer—by an allocation method.

If an experiential activity is required for all students and allocation is done by the university, then allocation can be challenging as it has to ensure that no individual is left unmatched (Divine, Linrud, Miller, & Wilson, 2007). On the other hand, if an activity is not required, it could be embarrassing for the school or university if students elect to not participate. For example, if an alumnus or corporate sponsor of a university offers to be a mentor to students and the offer goes unaccepted, it can result in a dissatisfied university partner, who might not return the next time the exercise is undertaken. Thus, universities need to ensure students are effectively and efficiently matched.

Whether it is an imbalance in supply and demand or inefficient allocation methods, there are barriers to coordinating placements for students to gain industry experience while completing their degree (Jackson, Rowbottom, Ferns, McLaren, 2017). Furthermore, matching students and employers can make the experiential activity administration process so difficult that some universities opt for intervention from third-party advisory services (Jackson, Ferns, Rowbottom, & McLaren, 2017). According to Niederle, Roth, and Sönmez, (2007), matching focuses on the question of *who gets what?* and assumes that the resource to be allocated is indivisible. However, allocation is more than

the concluding match itself, but a systematic mechanism that considers the preferences of involved parties and then pairs objects in an efficient way. Such mechanisms are widely studied in the field of Economics and are used to solve a variety of matching problems—from medical students in residency programs to on-campus student housing (Abdulkadiroglu & Sonmez, 1998; Masso, 2015).

The purpose of this study is to examine an allocation method named Sequential Choice Random Allocation *(SCRA)*, originally used to allocate sales students to a *One-Day Internship* employer: a single-day, job-shadow activity where students spend a day with a corporate partner of the university sales center to learn about the sales activities of a company (Billups, Johnson, & Poddar, 2020). These authors developed and refined the method over many years to allocate hundreds of students to employers, however, the comparative efficiency of the *SCRA* method remained untested. Beyond testing the *SCRA* method, this study also supports its efficiency and proposes its use in appropriate experiential learning contexts. The current research examines and compares the efficiencies and student satisfaction among three allocation matching mechanisms: Complete Random Allocation (*CRA*), Resume-Exchange Allocation (*REA*), and *SCRA*. Results of the study show support for greater efficiency and satisfaction of *SCRA*, compared to the alternative methods. The *SCRA* matching process not only allocates more students to their first, second, and third internship preferences, but takes less time to complete. In addition, student satisfaction with both outcome and process is greater for the *SCRA* compared to *REA* and *CRA* methods.

The remaining sections of the paper are organized as follows: 1) a review of each allocation method in an internship/employment context, including more details on the *SCRA* method and hypotheses; 2) methodology and results, and; 3) concluding discussion, limitations and future research.

ALLOCATION METHODS AND HYPOTHESES DEVELOPMENT

Matches are said to be efficient and optimal when any subsequent reallocated match cannot improve the utility (satisfaction received) of the participants (Hylland & Zeckhauser, 1979; Masso, 2015). As such, efficient resource allocation can be a challenging process in any domain. For example, matching kidney donors to transplant recipients requires biological constraints to be met between individuals before a transplant occurs (Masso, 2015). Roth and Shapley proposed a resolution to the kidney matching problem and were awarded the Nobel Prize in 2012 for their complex, algorithmic contribution of the Stable Allocation Theory (Economic Sciences, 2012). While no allocation method can lead to perfect allocation, their mechanism reduced unsuccessful kidney transplants due to incompatibilities between the donor and recipient. In another context, marriage matching can create a problem due to the lack of efficient allocation methods (Gale & Shapley, 1962). Similarly, medical programs face challenges assigning medical school graduates to residency programs due to capacity limitations and preference considerations (Niederle, Roth, & Sönmez, 2007; Roth 1984). The matching requirements in this present study are far less complex than kidney, marriage, or medical school allocations and thus, require a simpler mechanism, while still meeting the efficient and optimal matching parameters mentioned above. Below is discussion of the three matching methods used in this study, namely *CRA*, *REA*, and *SCRA*.

Complete Random Allocation

Randomized allocation has been widely used in society with procedures such as jury assignments or U.S. residency visas (Budish, Che, Kojima, & Milgrom, 2013). *CRA* is perceived as fair and symmetric as it removes any choice preference of involved parties (e.g., the applicant or employer) and offers equal probability of selection based on the number of individuals and available positions (Budish et al., 2013).

Although equitable in terms of choice probabilities and efficient in terms of time, the *CRA* method is not optimal when it comes to matching efficiency. Optimality is greatly lacking in this method as the utility of reallocated individuals could improve without decreasing the utility of others (Le Grand, 1990). In other words, there are many other matches that could be made that would be more preferred by those participating in the allocation. Furthermore, this method completely ignores both applicant and employer preferences throughout the process. Although *CRA* is an easy and time-efficient process it has little substantive appeal with internships and other experiential activities and is used primarily as a control condition in the context of the current study. *CRA* serves as an appropriate control method because it does not consider participants' choice preferences, which are present in both the *REA* and *SCRA* methods.

Resume-Exchange Allocation

The *REA* method follows a traditional application process where individuals apply to their preferred employer(s). Submitting a resume/application is often the first step from an applicant in the recruitment process as it is required by most employers (Udechukwu & Manyak, 2009). In this method, the preferences of both the applicant and employer are considered and each party acts as an agent in the process, making selections based on their own preferences, known as bilateral preference (Gale & Shapley, 1962). Initially, applicants showcase their desirable traits, like education levels or work and internship experience, via a resume (Nunley, Pugh, Romero, & Seals Jr., 2016). Employers then screen biographical data (i.e., attributes and abilities) in the resume to make selections of qualified candidates (Brown & Campion, 1994). To match students with experiential activities, universities often undertake a very time consuming and rigorous application process that entails student interviews to match the needs of the

students and the employer (Jackson, Rowbottom, Ferns, & McLaren, 2017).

Since the applicant and employer are both able to make their preferred selections in a bilateral match, both parties are presumably engaged in behavior that maximizes their expected utility (Hylland & Zeckhauser, 1979). This process is seemingly fair and therefore ubiquitously used for professional employment opportunities. Arguably, students have used this method already to apply for positions or are expecting to use it for application purposes in the future, and for this reason it was used in this investigation. However, there are consequences to this method that are worth considering. First, an applicant could possibly receive multiple rejections, leading to negative self-perception or resentment toward an employer(s) (Gilliland et al., 2001). Even when an applicant is matched, it is possible that they are not matched to their preferred organization at all. On the other hand, if applicants receive multiple offers they must select only one, possibly leaving the rejected employers to settle for a less preferred candidate or no candidate at all. Either of these scenarios can result in dissatisfaction for both parties. Given the bilateral nature of this method it is also very time consuming for both the employer, who must screen all applicants for a position, and for the applicant, who must apply to multiple employers and wait for a response. Additionally, if there is a highly desirable employer, then this particular party may be overwhelmed with applications, despite capacity limitations, leading to many applicants not being allocated at all. Thus, the *REA* matching process can lead to many unmatched pairs. That is primarily the reason why even when unemployment rates are high in an economy, many jobs remain unfulfilled (Sullivan, 2013).

While the *REA* method intuitively seems most likely to lead to optimal matches that claim has to be evaluated in a scientific manner. Thus, while there are obvious benefits to the bilateral match there may be instances when a simple, efficient, unilateral method is more appropriate.

Sequential-Choice Random Allocation

To produce efficient and optimal outcomes, allocation techniques should consider choice preferences and involve random assignment (Budish et al., 2013; Hylland & Zeckhauser, 1979). The *SCRA* method was developed to consider the choice preferences of students and also utilize random assignment if there is conflict between choice preferences of students. *SCRA* permits each applicant to enter the consideration set for their preferred position and then randomly removes individuals from positions according to capacity restraints. Unallocated agents are given an opportunity to choose among the remaining open positions, again randomly removing agents from any positions over capacity, and so on, until all positions have been filled. The *SCRA* model assumes that matching is not constrained by bilateral preference (Hylland & Zeckhauser, 1979), as the matching preferences of the host companies are not considered. Furthermore, this allocation method operates under the constraint that there are an equal number of agents and available positions. More details on the procedures of the *SCRA* allocation method are described in the methodology section below.

The *SCRA* method is arguably a blend of the *REA* and *CRA* methods as it includes random assignment but also provides agents with equal choice probabilities based on their preferences. This method is also interactive and happens quickly and can be done without the use of any computing resources. The disadvantage is that the employer has no input into the interns assigned to them, only the number of interns they can accept. This method is great if employers are willing to accept any interested student intern, as is the case in the allocation for *One-Day Internships,* mentioned before. Such a unilateral allocation method is also ideal for any match when one party is given choice preference and complete matching (no agents are left unallocated) is required.

Such matching opportunities exist in a university setting for other activities like class scheduling and mentorships. For example, students have to be matched to different sections of the same course during registration periods. Although classes may have capacity and/or prerequisite restrictions, faculty are generally not given consideration in the matching process, but it is the students' preferences (among other factors like assigned registration dates/times based on class rank) that determine the allocation. The goal of the university is to ensure that each section is viable at the end of the process and all students get a class.

Another example is a mentorship program. When universities offer a mentorship program, they have willing mentors who make themselves available to a pool of mentees. It is reasonable to assume that this allocation would happen unilaterally, as the mentees would presumably want to choose their mentors to the extent possible and mentors have little to no match preference. For example, in the paper by Nettleton & Bray, (2008) nursing school educators show uncertainly about whether freedom to choose for mentees or forced matching of mentees provides the best allocation method. In this circumstance, the *SCRA* offers an efficient and optimal allocation experience for individuals who are competing for these mentee positions. This is of particular importance, as unmatched individuals (both mentors and mentees) could have an impact on the long-term viability of a mentorship program for a university. Although these other activities are not the primary context of this research, they are worth noting as they all stand to benefit from efficient matching mechanisms.

Hypotheses Development

The measures of interest in this study are satisfaction with both the allocation process and outcome, time to complete the process (real and perceived), and the proportion of preferred internships allocated to the student agents.

Satisfaction with the process measures the students' perceptions regarding the allocation mechanism used to match agents with available positions. Before each of the three allocation mechanisms were tested, individuals were provided with information from the companies regarding each position. Individuals are more likely to be satisfied with a choice-process when information on choice options is given beforehand (Zhang & Fitzsimons, 1999). However, Zhang and Fitzsimons (1999) state that process satisfaction diminishes when choice options are restricted, which is inherent in the *CRA* method. Therefore, it is hypothesized:

H1a: Satisfaction with the process will be greater for the *SCRA* method than the *CRA* method.

H1b: Satisfaction with the process will not be different between the *SCRA* and *REA* methods.

Although *CRA* may be perceived as fair because of randomization, students are not assigned based on any level of preference, so their options may appear restricted. *SCRA* and *REA* both provide students with the opportunity to select a potential internship based on preference, so it is reasonable to assume that differences will exist between these and *CRA*, but may not exist between *SCRA* and *REA* in this measure of process satisfaction.

Satisfaction with the outcome is also affected by restrictions on choice options. When individuals perceive that they have exercised choice, instead of choices being dictated, levels of satisfaction with the outcome are greater (Botti & Iyengar, 2004). This is essentially a halo effect where a positive attitude toward an object extends to more favorable perceptions about other aspects of the same object (i.e., satisfaction with the outcome) (Han, 1989; Wu & Petroshius, 1987). Therefore, the following hypotheses are proposed:

H2a: Satisfaction with outcome will be greater for the *SCRA* method than the *CRA* method.

H2b: Satisfaction with the outcome will not be different between the *SCRA* and *REA* methods.

The preferences of individuals or parties being matched is an important consideration when designing an allocation method (Gale & Shapley, 1962). Another very important consideration is the time-cost tradeoff which looks at reasonable completion time of activities (Akkan, Drexl, & Kimms, 2005; Chen & Askin, 2009). In a university or industry setting, time may be limited or costly so minimizing the total time to complete an allocation process is absolutely necessary. In comparing different allocation methods, the completion time of the allocation process (time efficiency) is a very important component.

In this paper, time efficiency is defined in terms of both the real and perceived time required to allocate all students to a position. It is reasonable to predict that the *SCRA* method will take less time to complete than the traditional *REA* method, but not different from the *CRA* method, hypothesized as such:

H3a: Time efficiency will be greater for the *SCRA* method than the *REA* method.

H3b: Time efficiency will not be different between the *SCRA* and *CRA* methods.

The most important outcome of any matching process is matching efficiency (i.e., the number of people matched to their preferred choices). If a process is fast (time efficient) and also matches a large proportion of participants to their first choices, it can be considered an efficient matching process. Proportions of preferred internships allocated are expected to be greater for *SCRA* than *CRA* because student preferences are considered in the former. However, it is predicted that the proportion of preferred allocations will be greater for *SCRA* than *REA*, due to the inherent complexity of a bilateral match when preferences between two parties must align. To measure matching efficiency the first, second, and third internship choice preferences of students are captured before the allocation process begins so as to compare it to their final allocation. The following matching efficiency hypothesis is proposed:

H4: Proportions of students who received their first, second, and third internship choice will be greater for the *SCRA* method than either the *REA* or *CRA* methods.

METHODOLOGY

Sample and Measures

The subjects were undergraduate business students in one section of an introductory marketing class (*N*=29) in a US university in the Mid-Atlantic region. The study was approved by the university IRB and before participating, students read and signed a consent form before participating in the experiments.

Satisfaction with the outcome was assessed using five items adapted from Brown and Peterson's scale of job satisfaction in a sales-role context (1994): 1) Overall, I was satisfied with the final outcome of the allocation method; 2) Considering the limitations of time, the final outcome of the allocation was very good; 3) If I had to do it again, I would like the university to use the same allocation method to allocate interns; 4) Because of the outcome, I would recommend the same allocation method to other students; and 5) I got the internship I wanted. These were measured using 7-point bipolar scales (endpoints: strongly disagree-strongly agree) across the *CRA*, *SCRA* and *REA* allocation groups (α = .91, .96, .87, respectively). The five items in this measure were summated to create an aggregate outcome satisfaction measure.

Satisfaction with the process was assessed using six items also adapted from Brown and Peterson (1994): 1) Overall, I was satisfied with the internship allocation process; 2) The allocation process employed was very fair; 3) If I were to do it again, I would prefer to use this allocation process; 4) I would recommend that the university use this allocation process for distributing internships; 5) I found the allocation process very exciting; and 6) I found the time spent in the allocation process very worthwhile. These were again measured using 7-point bipolar scales (endpoints: strongly disagree-strongly agree) across the *CRA*, *SCRA* and *REA* internship allocation groups (α = .84, .90, .90, respectively). The six items in this measure were similarly aggregated.

Time efficiency was measured according to the perceived time to complete the allocation process using a single-item measure "The allocation process took too long" (1-Strongly disagree; 7-Strongly agree) and actual time (recorded by the principal investigators). Allocation efficiency was measured by the proportion of subjects who received their first, second, and third internship choice.

Procedure

Prior to any allocation process, subjects watched a short video provided by each participating company that explained the benefits of choosing their company for the *One-Day Internship*. Subjects were told that each company could only accept a limited number of interns (this number was allocated randomly to create realism in the exercise, with a minimum of three and a maximum of seven). Next, students were asked to list their internship choice preferences by company, from first to last. Subjects participated in three different allocation methods, over two days, each resulting in an internship match. After participating in each of the allocation methods, students took a brief survey about their experience.

The first method tested was *CRA*. Each subject's name was printed, placed in a container, drawn randomly, and then assigned to an employer. This allocation method took approximately 5 minutes to complete.

The second method tested was the *REA*. The subjects were asked to submit their applications to as many of their preferred employers as they wanted and then wait for a response from the employers. Subjects were instructed to apply by email and include their resume as an attachment. Faculty and graduate students (not linked with the research) acted as employers and were given specific instructions on how to communicate with the applicants and considerations for selecting qualified candidates, like the presence of a good cover letter, GPA, work experience, etc., found in the student resumes. We specifically instructed the "employers" to complete the evaluations of the applicants as fast as possible. In real life employers are likely to take much more time to evaluate each candidate.

After employers decided on a qualified candidate they sent email offers to their top choices up to their maximum quota (as mentioned earlier each employer was provided with a quota) and waited for confirmation of acceptance. If an applicant received multiple offers, they were asked to accept only one and inform the other interested companies via email to remove their names from the consideration set. On the other hand, company representatives were provided the following instructions: if a company had a quota of 5, but only got 4 applications, they had to make offers to all 4 applicants (this rule is stricter than what happens in reality, as real-world employers may decide not to accept any of the 4 applicants). If all 4 accepted, the company would be left with 1 unfulfilled position. However, if the company had been allotted 5 positions and got 15 applicants, they were to make 5 offers to their top choice candidates and if all offers were accepted, they were finished with the allocation process. Additionally, if this same company were to make 5 offers and only received 2 acceptance replies then the company could return to their list of applicants and make 3 more offers to the next best qualified candidates, which those candidates could again either accept or reject. The process continued until each company met their quota or ran out of applicants. This allocation method took approximately 70 minutes to complete (with one student who did not get matched).

The third method tested was the *SCRA* method. After viewing the videos, each student placed a self-identifying token into a container bearing the name of their preferred company. Tokens are then counted for each employer and if an employer meets capacity (e.g., 5 positions available and only 5 students select the position) then the position is closed and removed from the consideration set. If an employer is under capacity (e.g., 5 positions available and only 3 students select the position) then those students are matched to the sponsor and the employer remains for subsequent rounds with a modified capacity—initial capacity minus the successful matches. If an employer is over capacity (e.g., 5 positions available and 9 students select the position) then 4 names are randomly removed from the container and these students are then asked to select another available employer and the 5 remaining names in the container are matched to that employer. This procedure is repeated until all the subjects have been assigned an internship. This allocation method took approximately 5 minutes to complete.

RESULTS

A repeated-measure analysis of variance (ANOVA) was conducted with a Greenhouse-Geisser correction to correct for sphericity violations present in the model. The difference in participants perceptions of satisfaction with the process and outcome across three internship allocation methods was evaluated (N=29). This sample size was justified for this within-subjects design based on meeting normality assumptions (Oberfeld & Franke, 2013), sphericity assumptions (Doane & Seward, 2011), and effect size unique for within-subjects ANOVA (Barcikowski & Robey, 1985). The results indicate a significant method effect, Wilk's Lambda = .297, $F(4, 25) = 14.83$, $p < .001$, and partial $\eta^2 = .703$ (see Table 1).

Post hoc comparisons, using the Bonferroni correction, indicated statistically significant mean differences for process satisfaction between the *CRA* and *SCRA* methods (M_{CRA}= 3.07, M_{SCRA}= 4.61, p < .001), in support of H1a, and between the *CRA* and *REA* methods (M_{CRA}= 3.07, M_{REA}= 4.87, p < .001), but not between the *SCRA* and *REA* methods (M_{SCRA}= 4.61, M_{REA}= 4.87, p = 1.00), in support of H1b. Similarly, mean differences were found for outcome satisfaction between the *CRA* and *SCRA* methods (M_{CRA} 3.16, M_{SCRA}= 5.32, p = .003), in support of H2a, and between the *CRA* and *REA* methods (M_{CRA}= 3.16, M_{REA}= 4.83, p

< .001), but not between the *SCRA* and *REA* methods (M_{SCRA}= 5.32, M_{REA}= 4.83, p = .855), in support of H2b.

Table 1: Satisfaction across allocation methods

Pairwise comparisons: Satisfaction with process

	Mean	SD	SE	Mean	SD	SE	**Significance**
CRA vs. SCRA	**CRA**			**SCRA**			Significant (p ≤.001)
	3.07	1.22	0.228	4.61	1.36	0.254	
CRA vs. REA	**CRA**			**REA**			Significant (p ≤.001)
	3.07	1.22	0.228	4.87	1.22	0.227	
SCRA vs. REA	**SCRA**			**REA**			Not Significant (p = 1.00)
	4.61	1.36	0.254	4.87	1.22	0.227	

Pairwise comparisons: Satisfaction with outcome

	Mean	SD	SE	Mean	SD	SE	**Significance**
CRA vs. SCRA	**CRA**			**SCRA**			Significant (p ≤.05)
	3.16	1.59	0.295	5.32	1.94	0.361	
CRA vs. REA	**CRA**			**REA**			Significant (p ≤.001)
	3.16	1.59	0.295	4.83	1.3	0.243	
SCRA vs. REA	**SCRA**			**REA**			Not Significant (p = .855)
	5.32	1.94	0.361	4.83	1.3	0.243	

Overall, participants were less satisfied with the outcome and process of *CRA*. This is understandable as such a practice ignores the preferences of both interns and employers and leaves the allocation to chance only. This method served as a control condition and is generally not utilized in the internship market. However, no difference was found in satisfaction with process or outcome between the *SCRA* and *REA* methods. The *REA* method is traditionally accepted as the common allocation method in the internship market, incorporating intern choice with employer discretion. Comparatively, the *SCRA* method is unorthodox as it considers intern choice only.

Additionally, while the *CRA* and *SCRA* methods took only 5 minutes to complete, the *REA* method was recorded at 70 minutes. Respondents subjective assessments about time also confirmed the real-time findings as respondents felt like *REA* took significantly more time than *SCRA* (M_{SCRA}= 2.46, M_{REA}= 3.75, p = .009), thus confirming H3a. However, respondents assessed no significant difference between the *CRA* and *SCRA* regarding time to complete the process (M_{CRA}= 2.07, M_{SCRA}= 2.46, p = .954), confirming H3b.

Table 2: Perceived and actual times across allocation methods

Pairwise comparisons: Perceived time

	Mean	SD	SE	Mean	SD	SE	**Significance**
CRA vs. SCRA	**CRA**			**SCRA**			Not Significant (p = .954)
	2.07	1.46	0.277	2.46	1.77	0.335	
CRA vs. REA	**CRA**			**REA**			Significant (p ≤.05)
	2.07	1.46	0.277	3.75	1.5	0.285	
SCRA vs. REA	**SCRA**			**REA**			Significant (p ≤.05)
	2.46	1.77	0.335	3.75	1.5	0.285	

Pairwise comparisons: Actual time (approximate)

	Time In Mins	Time In Mins	**Actual Time difference**
CRA vs. SCRA	**CRA**	**SCRA**	None
	5 mins	5 Mins	
CRA vs. REA	**CRA**	**REA**	65 min
	5 mins	70 mins	
SCRA vs. REA	**SCRA**	**REA**	65 min
	5 mins	70 mins	

Beyond mean comparison, the real effectiveness of each method can be compared by calculating actual proportions of students who received their first, second, or third internship choice and the approximate time to complete each allocation (see Table 2 and 3). The *CRA* method allocated only 10%, 23%, and 37% of students to their first, second, or third choice, respectively. The *SCRA* method on the other hand had 66%, 69%, and 72% of students receive their first, second, or third choice, respectively. This was substantially higher than the *REA* matching method results of 28%, 45%, and 66% of students receiving their first, second, or third choice, respectively, in support of H4. Thus, in the *SCRA* method, 66% of the students received their preferred internship choice, while in the *REA* method, only 28% of the students received their first choice. As the number of students to be allocated increases, these differences between the *SCRA* and *REA* methods are expected to be starker, especially in the time taken to complete the allocation. This happens as when the number of participants increases in the two-sided (bilateral matching) *REA* method each employer now has to devote more time evaluating applicants to find an ideal candidate.

Table 3: Proportion of preferred matches

	CRA			**SCRA**			**REA**		
Match outcome	1st	1st & 2nd	1st, 2nd & 3rd	1st	1st & 2nd	1st, 2nd & 3rd	1st	1st & 2nd	1st, 2nd & 3rd
# of preferred matches	3	7	11	19	20	21	8	13	19
# of students	29	29	29	29	29	29	29	29	29
Proportion matched	**10%**	**24%**	**38%**	**66%**	**69%**	**72%**	**28%**	**45%**	**66%**

Note: Proportion matched percentages are cumulative totals for each respective allocation method.

Discussion and Implications

A successful match of a student intern and employer requires an appropriate allocation mechanism. Matching techniques that cannot improve agent utility (derived satisfaction) through any subsequent reallocation are said to be efficient and optimal. Beyond this measure, efficient matches could also consider process time, proportion of preferred matches, and perceived satisfaction with the allocation process and matching outcome.

SCRA is a unique allocation method that was originally created to match sales students to corporate sponsors of a university sales program for a *One-Day Internship*. Results of this study support that *SCRA* was not only more time efficient than *REA* but also generated substantially higher matching efficiency. Furthermore, participants allocated using *SCRA* perceived the allocation process and subsequent matching outcomes to be more satisfying, compared to *REA* and *CRA*. Although the resume exchange takes both parties preferences into consideration and is predominantly used in the hiring process, proportion and satisfaction levels of *SCRA* was still greater than *REA*.

Universities that represent a large student base and have partnerships with employers who require short-term interns or mentees could use the *SCRA* method instead of more time consuming and less satisfying processes like *REA* or *CRA*. *SCRA* can be used to solve other unilateral (non-bilateral) matching problems, especially when student preference is favored and randomization is valued.

Allocation methods, despite their limitations, need to ensure that the target population (students in our case) get their preferred choice to the greatest extent possible. The *SCRA* method is not only time efficient, but produces a higher matching efficiency (i.e. the number of students matched to their preferred choice) than alternative methods. In the case of the widely used *REA* method it would seem that when both parties are able to make their preference known, it would lead to more efficient matching. However, this research showed that not to be the case, at least from the perspective of the students' choice preferences. In addition, the *SCRA* was found to produce greater process satisfaction. Although the resulting match of the allocation is arguably the most important factor, satisfaction with the process is worthy of consideration. Such satisfaction is related to the participant's perceptions of choice fairness and may also have positive spillover effects on perception of the match outcome (i.e., the employer, mentor, etc.). Furthermore, process satisfaction may serve to recruit more participants initially for experiential learning activities that require matching. A short summary table of the general pros and cons of the different methods is

provided (see Table 4) so readers can select an appropriate method based on their specific needs.

Table 4: Pros and cons of each allocation methods

	CRA	SCRA	REA
Allocation time	Low	Low	High
Percentage of preferred first allocations	Low	High	Medium
Party preferences considered	Neither Students nor Employers	Only Students	Both Students and Employers
Process satisfaction for students	Low	High	High
Outcome satisfaction for students	Low	High	High
Possibility of non-allocation for students	No	No	Yes
Complexity of allocation process	None	Low	High
Time commitment for employers	None	Low	High
Possibility of not filling allocation quota for employers	No	No	Yes

Note: Ratings for CRA, SCRA and REA across the categories are considered under the constraints of the current study (equal number of students and positions).

Limitations and Future Research

Like all papers this research also has some limitations that need to be noted while interpreting or using the findings. *SCRA* is unilateral and thus ignores the preferences of employers, beyond position capacity restrictions. It is reasonable to assume that full-time internships or employment opportunities may require more involvement from employers than offered by *SCRA*. Although efficiency measures are more favorable for *SCRA* than *REA*, many employers would still prefer the latter because of the ability to choose, whereas the efficiency, optimal, and satisfaction measures used in this study are agent-centered (students).

Regarding choice, future research could explore how the number of choice options affects students' perceptions and allocation outcomes. While this study supports the notion that perceived choice results in greater levels of satisfaction (Botti & Iyengar, 2004), it is likely possible that students or agents can become burdened with the volume of choice options and experience choice overload (Iyengar & Lepper, 2000).

Although this study equated number of students and available positions, that is not always the case in actual matching settings. As results indicate, even with an equal number of allocation participants the *REA* method can still leave students unallocated. However, if there happens to be more students than available positions then all three allocation methods will be challenged to produce the same level of effective matches and student satisfaction as seen in the current study.

SCRA is also similar to Random Serial Dictatorship (*RSD*), another allocation method used and discussed in economic literature (Abdulkadiroglu & Sonmez, 1998). This lottery-based allocation mechanism assigns random order successively, and each individual selects their preferred choice after their name is drawn, and so on, until all positions are filled. Conversely, *SCRA* extends first-choice preference to all students and then uses randomization to remove students from positions over capacity. The *SCRA* method may generate higher levels of satisfaction than *RSD* because of perceived fairness in allowing agents to select their preferred choice before randomization occurs. Given the similarities between the *SCRA* and *RSD* methods and their reliance on preference and randomization, these methods could be studied in comparison in future research. It could be interesting to see if *RSD* offers any advantages over *SCRA* in terms of proportion of students who received their first, second, and third internship choice as well as satisfaction with the allocation process and matching outcome.

REFERENCES

Abdulkadiroglu, A., & Sonmez, T. (1998). Random serial dictatorship and the core from random endowments in house allocation problems. *Econometrica*, *66*(3), 689.

Akkan, C., Drexl, A., & Kimms, A. (2005). Network decomposition-based benchmark results for the discrete time–cost tradeoff problem. *European Journal of Operational Research*, 165(2), 339-358.

Barcikowski, R. S., & Robey, R. R. (1985). Sample Size Selection In Single Group Repeated Measures Analysis.

Billups, M.J., Johnson, A., Poddar, A. (2019). *One-Day Internship*s: An experiential activity connecting sales students and local corporate sponsors. *Journal of Selling (forthcoming)*

Botti, S. & Iyengar, S. (2004). The psychological pleasure and pain of choosing: when people prefer choosing at the cost of subsequent outcome satisfaction. *Journal of personality and social psychology*, *87*(3), 312.

Brown, B. K., & Campion, M. A. (1994). Biodata phenomenology: Recruiters' perceptions and use of biographical information in resume screening. *Journal of Applied Psychology*, *79*(6), 897.

Brown, S. P., & Peterson, R. A. (1994). The effect of effort on sales performance and job satisfaction. *Journal of Marketing*, *58*(2), 70-80.

Budish, E., Che, Y. K., Kojima, F., & Milgrom, P. (2013). Designing random allocation mechanisms: Theory and applications. *American Economic Review*, *103*(2), 585-623.

Burnett, M. S., & Pettijohn, C. (1999). Improving student performance through student mentorships: Practices, prescriptions and policies for enhanced learning. *Marketing Education Review*, *9*(1), 61-70.

Chapman, J., Schetzsle, S., & Wahlers, R. (2016). An innovative, experiential-learning project for sales management and professional selling students. *Marketing Education Review*, *26*(1), 45-50.

Chen, J., & Askin, R. G. (2009). Project selection, scheduling and resource allocation with time dependent returns. *European Journal of Operational Research*, 193(1), 23-34.

Coco, M. (2000). Internships: A try before you buy arrangement. *SAM Advanced Management Journal*, *65*(2), 41.

Divine, R. L., Linrud, J. K., Miller, R. H., & Wilson, J. H. (2007). Required internship programs in marketing: Benefits, challenges and determinants of fit. *Marketing Education Review*, *17*(2), 45-52.

Doane, D. P., & Seward, L. E. (2011). Measuring skewness: a forgotten statistic? Journal of statistics education, 19(2).

Economic Sciences Prize Committee of the Royal Swedish Academy of Sciences. Stable matching: theory, evidence, and practical design. The Prize in Economic Sciences 2012, Information for the Public, October 2012. Retrieved March 1, 2020 from http://www.nobelprize.org/nobel_prizes/economics/laureates/2012/popular.html

Gale, D., & Shapley, L. S. (1962). College admissions and the stability of marriage. *The American Mathematical Monthly*, 120(5), 386-391.

Gault, J., Redington, J., & Schlager, T. (2000). Undergraduate business internships and career success: Are they related? *Journal of Marketing Education*, *22*(1), 45-53.

Gilliland, S. W., Groth, M., Baker IV, R. C., Dew, A. E., Polly, L. M., & Langdon, J. C. (2001). Improving applicant's reactions to rejection letters: An application of fairness theory. *Personnel Psychology*, *54*(3), 669-703.

Han, C. M. (1989). Country image: halo or summary construct? *Journal of Marketing Research*, 26(2), 222-229.

Hylland, A., & Zeckhauser, R. (1979). The efficient allocation of individuals to positions. *Journal of Political economy*, *87*(2), 293-314.

Iyengar, S. S., & Lepper, M. R. (2000). When choice is demotivating: Can one desire too much of a good thing? Journal of personality and social psychology, 79(6), 995.

Jackson, D., Ferns, S., Rowbottom, D., & Mclaren, D. (2017). Improving the work-integrated learning experience through a third-party advisory service. *International Journal of Training Research*, 15(2), 160-178.

Jackson, D., Rowbottom, D., Ferns, S., & McLaren, D. (2017). Employer understanding of work-integrated learning and the challenges of engaging in work placement opportunities. *Studies in Continuing Education*, 39(1), 35-51.

Le Grand, J. (1990). Equity versus efficiency: the elusive trade-off. *Ethics*, *100*(3), 554-568.

Mader, F. H., Mader, D. R., & Alexander, E. C. (2017). Job shadowing experiences as a teaching tool: A new twist on a tried and true technique. *Atlantic Marketing Journal*, *5*(3), 8.

Mantel, S. P., Pullins, E. B., Reid, D. A., & Buehrer, R. E. (2002). A realistic sales experience: Providing feedback by integrating buying, selling, and managing experiences. *Journal of Personal Selling & Sales Management*, *22*(1), 33-40.

Massó, J. (2015). The theory of stable allocations and the practice of market design. The Nobel Prize in Economics 2012 for Alvin E. Roth and Lloyd S. Shapley. *Contributions to Science*, *11*, 103-112.

McCarthy, P. R., & McCarthy, H. M. (2006). When Case Studies Are Not Enough: Integrating Experiential Learning Into Business Curricula. *Journal of Education for Business*, 81(4), 201–204.

Nettleton, P., & Bray, L. (2008). Current mentorship schemes might be doing our students a disservice. *Nurse Education in Practice*, *8*(3), 205-212.

Niederle, M., Roth, A. E., & Sönmez, T. (2007). *The New Palgrave Dictionary of Economics*, 2nd edition, Palgrave Macmillan.

Nunley, J. M., Pugh, A., Romero, N., & Seals Jr, R. A. (2016). College major, internship experience, and employment opportunities: Estimates from a résumé audit. *Labour Economics*, *38*, 37-46.

Oberfeld, D., & Franke, T. (2013). Evaluating the robustness of repeated measures analyses: The case of small sample sizes and nonnormal data. Behavior research methods, 45(3), 792-812.

Roth, A. E. 1984. "The evolution of the labor market for medical interns and residents: A case study in game theory." *Journal of Political Economy*, 92, 991-1016.

Sullivan, Amy (2013), "Why jobs go unfulfilled even in times of high unemployment", *The Atlantic*, Aug 13, Last Accessed: 11/14/2019; Available at: https://www.theatlantic.com/business/archive/2013/08/why-jobs-go-unfilled-even-in-times-of-high-unemployment/278801/

Udechukwu, I., & Manyak, T. (2009), "Job applicants' perceptions of resumes versus employment application forms in the recruitment process in a public organization", *Public Personnel Management*, 38(4), 79-96.

Weible, R. (2009). Are universities reaping the available benefits internship programs offer? *Journal of Education for Business*, *85*(2), 59-63.

Weible, R. & McClure, R. (2011) An exploration of the benefits of student internships to marketing departments, *Marketing Education Review, 21*:3, 229-240.

Wu, B. T., & Petroshius, S. M. (1987). The halo effect in store image measurement. *Journal of the Academy of Marketing Science*, 15(3), 44-51.

Wurdinger, S., & Allison, P. (2017). Faculty perceptions and use of experiential learning in higher education. *Journal of e-learning and Knowledge Society*, *13*(1).

Zhang, S., & Fitzsimons, G. J. (1999). Choice-process satisfaction: The influence of attribute alignability and option limitation. *Organizational behavior and human decision processes*, *77*(3), 192-214.