

Entrepreneurial Adaptation and Social Networks: Evidence from a Randomized Experiment on a MOOC Platform

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Abstract:

To assess the impact of suggesting different approaches to the strategic process to early-stage entrepreneurs, we examine their before-and-after performance in a randomized field experiment. Contrary to the finding that entrepreneurs should be adaptive and open to changing their business model and strategic direction frequently, we find that instructing entrepreneurs to have a strong, persistent vision for their startup often results in better performance in the early stages. However, we find that having more diverse social ties can mitigate the disadvantage of the adaptive approach at the beginning of the venture. Further, we find that while the planning approach works in the very early stage, a two-year follow-up survey indicates the adaptive approach yields better outcomes in terms of revenues and fundraising. However, the adaptive approach with a diverse mentor tie continues to yield better outcomes in the follow-up survey, suggesting that the advantage of coupling adaptive approach with diverse social ties continues to persist. The results show that the formulation of a strategic approach benefits from consideration of the interaction with social network ties.

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Introduction

Under what conditions is it better to create business strategy using a planning process versus using a more flexible, adaptive process? It has been argued that strategy in early-stage ventures is based less on planning and positioning than it is on a more flexible, discovery-driven process (Baker & Nelson, 2005; Brown & Eisenhardt, 1997; McGrath, 2010). Conversely, others provide empirical evidence showing that business planning facilitates the development and survival of ventures (Delmar and Shane, 2003). Despite this research, we know relatively little about the conditions under which each strategy formulation process works best. The debate over the relative benefits of planning versus adaptive processes has created a theoretical puzzle in understanding the conditions and complementary factors that may facilitate each approach. The research question we seek to answer is what type of strategic process should entrepreneurs follow and how is this choice moderated by social network ties?

This question is even more important in light of the growth in accelerator programs and educational initiatives that often encourage a more adaptive strategic process and that provide advisory network ties (Eesley & Miller, 2012; Fayolle, 2000; Fayolle, Gailly, & Lassas-Clerc, 2006; Kuratko, 2005; Von Graevenitz, Harhoff, & Weber, 2010). For example, the JOBS Act and Startup America have allocated \$400M dollars for mentorship and funding.² The massive open, online course (MOOC) setting helps us to make progress on empirical challenges by allowing us to use a pre-test, post-test randomized controlled trial to examine various strategic processes and identify the conditions where they outperform. Similar to digital and social media (Wu & Brynjolfsson, 2014), the MOOC setting allows for a novel research design that permits us to observe the strategy formulation process with a finer grain of precision, and to detect the

² <http://s.co/press-release/april20commitments>. In addition, the National Science Foundation (NSF) has launched an \$18M program to pair SBIR grantees with entrepreneurship training and mentors. This program teaches these a more adaptive process for startup creation. SBIR: Small Business Innovation Research, <http://www.sbir.gov/>, https://www.nsf.gov/news/special_reports/i-corps/

mechanisms behind early-stage venture performance that are otherwise difficult to observe. We respond to calls in the literature for the use of field experiments in strategy research (Chatterji et al. 2016).

We randomly assign different versions of the same assignments that guide the participants towards different venture strategies. By prompting students toward adopting either planning or adaptive strategies as well as prompting them to find a mentor who could improve their overall network diversity, we show that the combination of the venture strategic process and network diversity introduced through mentors can affect performance. We find that having a mentor who could increase the founder's overall network diversity results in a heterogeneous effect that depends on the venture strategy. When the entrepreneur chooses the adaptive approach, having a mentor with diverse social ties can significantly improve the venture's outcomes; however, it does not influence the outcome of the planning approach. Overall, these results suggest the importance of jointly considering venture strategies alongside the effect of social networks because they can have important interaction effects.

Our analyses are unique in several ways. First, through a novel research design, we are able to observe more closely a diverse population of potential entrepreneurs as they go through the early stages of firm formation. Second, by using randomized experiments, the usual endogeneity concerns, such as selection or omitted variable biases, are reduced by some degree, thereby enabling us to make relatively stronger causal inferences. MOOCs can serve as a platform that scholars should increasingly consider to aid in understanding and addressing many difficult problems faced in strategy research.

Planning vs. Adaptive Processes in Entrepreneurship

Recent literature in strategy outlines two main approaches that guide the strategic process: [1] planning and [2] adaptive processes. The planning model emphasizes prediction and planning based on the positioning model of firm strategy (Porter, 1980). Entrepreneurs have argued for using comprehensive planning in order to reduce environmental uncertainty (Schwenk and Shrader 1993; Shrader, Mulford and Blackburn, 2013). The entrepreneurs are expected to create a vision and then execute on a plan to realize the vision. They may start with analyzing the market, including growth rates, and new market segments to create a vision and then develop a plan to produce products and services to fill the identified needs of consumers. Finally, go-to-market strategies are planned, resources are gathered, and execution is tracked. While the planning approach has been shown to have a positive impact on firm performance (as shown in meta analysis), a literature review finds contradictory results, suggesting that there may be complementary factors moderating the relationship (Brinckmann, Grichnik, & Kapsa, 2010). Bringing the literatures on strategic process and network theory together may be useful in explaining venture performance when complementary factors are present. For example, prior work finds that the venture's strategy must be aligned with the team composition and industry environment (Eesley, Hsu and Roberts, 2014). Yet, despite this literature on venture strategy, we still know relatively little about whether guided changes in a venture's strategic process or an exogenously altered in social networks produce improved performance outcomes.

In contrast to the planning strategy, diverse streams of strategy and entrepreneurship literature broadly propose a similar view of a more adaptive, flexible mode of strategy. These are made under the labels of experimentation (Kerr, Nanda, & Rhodes-Kropf, 2014), discovery-driven planning (McGrath, 2010), dynamic capabilities (Eisenhardt & Martin, 2000; Teece, 2007), improvisation, bricolage (Baker & Nelson, 2005), and effectuation (Sarasvathy, 2001).

These have an adaptive model in common. Due to the uncertain environments that startups typically operate in, ventures should not plan and position in the early stages; instead entrepreneurs must adapt to feedback quickly. Strategic planning is linked to the predictability of the environment since strategic plans are typically based on future market needs and growth opportunities (Hiatt and Sine, 2014; Mintzberg, 1994; Wiltbank, Dew, Read, & Sarasvathy, 2006). A long-term competitive advantage is rare and a series of short-term competitive advantages may be more feasible (Chen, Katila, McDonald, & Eisenhardt, 2010). The entrepreneur begins with the resources available and remains open to adapting in response to new information and to meeting needs she discovers rather than adhering to a singular vision (Baker et al. 2003).

The key advantage of the adaptive strategy may be that it is inherently more suited to take advantage of new information, especially if it deviates from what was predicted or somehow suggests other paths may be more feasible. When an entrepreneur using adaptive processes receives novel information, she is more likely to use the information even when it may not conform to the original vision. Creating a plan does not mean that an individual is precluded from being able to adapt the plan. However, an entrepreneur using the planning process is more likely to ignore or discard information that detracts from or contradicts her original vision.

Social Networks and Entrepreneurship Outcomes

The social network of the founder can have a significant impact on the ability to receive and act on valuable information in forming firm strategy (Ingram & Roberts, 2000; Lerner & Malmendier, 2013; Nanda & Sørensen, 2010). We know from prior social network literature that direct ties shape entrepreneurial entry (Stuart & Ding, 2006) as well as performance (Dahl & Sorenson, 2012; Rider, 2009; Roberts & Sterling, 2012). For example, social status, conferred

through network ties with customers and investors, has been shown to improve entrepreneurial performance, including performance in fundraising (Burton, Sørensen, & Beckman, 2002; Roberts & Sterling, 2012). In spite of a long literature on the social networks of entrepreneurs, we still know relatively little that is empirically well-identified about whether guided changes in social network ties can produce the intended performance outcomes.

One aspect of how network ties matter is in their role of providing information and resources. Direct and indirect ties influence the selection of ventures that are funded because these ties provide important informational signals about the quality of the entrepreneur and her project (Nicolaou & Birley, 2003; Shane & Stuart, 2002; Shane & Cable, 2002). Some scholars have also argued that in addition to the direct ties, the triadic connections of the founder can play an important role in entrepreneurial performance (Burt, 2004). Specifically, individuals with high-network diversity, or brokers, can obtain information benefits by facilitating the flow of information from otherwise unconnected groups (Burt, 1992; Burt, 1997; Cross & Cummings, 2004; Lin, 2008; Wu, 2013). In this type of network, individuals have more expansive but non-overlapping ties, and can thus reach into different pockets of the overall social networks more effectively than those with a more structurally constrained network. Recent work has quantified the direct information benefits from having network diversity. For example, information diversity as the result of having high network diversity is shown to positively affect work productivity as well as improving career paths (Aral & Van Alstyne, 2011; Wu, 2013). Jeppesen and Lakhani (2010) examine problem-solving contests. They find that winning solutions were positively related to the diversity and uniqueness of information the solver brought to bear on the problem. Thus, individuals with high network diversity are in a unique position to receive novel information and use it to their advantage. When mentors come from a different social network

space, they can provide non-redundant information, which can be especially helpful in information-intensive environments, such as starting a venture, as well as helping the entrepreneur to strategically use the information in her favor. These mentors can also make unique introductions, provide strategic guidance, or even introduce investors, early adopters or potential cofounders. Through their diverse networks, mentors can not only help providing key information critical to venture strategies and success, they are also more likely to influence the mindset of the entrepreneur, reducing over-confidence or broadening their thinking to include more diverse perspectives.

Interaction Effects of Network Diversity and Strategic Decision-making

We draw on the insight from the literature on social network ties to contribute to the literature on how strategic processes influence venture performance. The optimal advisory network ties may differ according to the entrepreneur's strategic process. We expect that a mentor who can expand an entrepreneur's network will only work well with an adaptive strategy, whereas the same mentor may not benefit an entrepreneur who uses a planning strategy. An entrepreneur who uses the adaptive process is receptive to extra mentoring that can help create the plan. Through co-creating a vision with the mentor's input, an adaptive entrepreneur is more likely to utilize the information and resources provided by the mentor and adjust her business model accordingly. Information and guidance is critical for entrepreneurs to seize new opportunities and gain competitive advantage. For instance, if the venture is shifting to pursue an opportunity that is not in the founder's own industry experience, a mentor may provide industry knowledge on regulatory strategy or marketing. Such industry knowledge has been shown to be important, both technical and nontechnical knowledge (Chatterji, 2009; Eesley and Roberts, 2012). However, the information is only useful when the entrepreneur is receptive and willing to

act on it. Adaptive processes prompt the entrepreneur to be more receptive and find ways to better utilize the mentor's new information and resources. Bringing resources into the venture, the mentor is also more likely to influence the entrepreneurial process and feel like she has a greater stake in the venture. The entrepreneur using an adaptive strategy is likely to benefit more from a mentor whose network adds diversity because of the unique and novel information and contacts offered by the mentor. In the rapid-paced environment of a start up, information can be a significant competitive advantage to entrepreneurs who need it and are willing to use it.

H1: A diverse mentor will positively moderate the impact of an adaptive strategic process on early-stage entrepreneurial performance.

Entrepreneurs using the planning process may find access to information to be less important than it is to those using the adaptive approach. Under a planning process, the entrepreneur is less likely to modify his vision because of his strong belief in it and may reject information brought by the mentor if it fails to conform to the vision that the plan is based on. The novel information offered by a mentor with high network diversity is thus less useful to the entrepreneur. The entrepreneur may benefit more from a like-minded mentor who is likely to understand the vision and can help the entrepreneur realize it. A mentor in the same cohesive network as the entrepreneur is can more effectively communicate and operationalize the vision. In addition, the cohesive network facilitates building trust and transferring status signals that could help an entrepreneur to achieve goals in the planning strategy. The greater level of trust enables the entrepreneur to be more open with the mentor in communicating problems they are encountering, whether these are challenges in team dynamics, uncertainty over what next steps to take, or difficulties that are anticipated in the business. An entrepreneur may hesitate to share such sensitive topics with a mentor who has more diverse ties and thus who may share such information more broadly. In contrast, with a mentor whose ties overlap more, the cohesion and

trust allows the entrepreneur to communicate more freely, which may be particularly beneficial when undertaking a planning process. Under a planning process, errors or negative feedback may reflect poorly on the entrepreneur who has generated the plan and communicated a strong vision. This dynamic makes it relatively more important for the entrepreneur to have a trusted confidant, rather than to have a mentor who has access to more diverse contacts and divergent points of view. Thus, we expect that adaptive, flexible strategic processes will be enhanced by mentors with diverse network ties due to the information benefits; whereas a persistent and planning-based strategic process may benefit to a lesser extent.

H2: A non-diverse mentor tie will positively moderate the impact of a planning-driven strategic process on early-stage entrepreneurial performance.

Experimental Design and Setting

We use a randomized field experiment to test our hypothesis. Randomization is important in this context because it is difficult to observe the entrepreneurial process; and even when it is observable, disentangling various confounding factors that could simultaneously affect outcomes remains a challenge. For example, it may be observed that having a mentor is correlated with a superior outcome, yet it remains unclear whether it was the mentor's guidance that was responsible for the success of the venture or that the correlation can be explained by the fact that good business ideas tend to attract superior mentors. Without finding an exogenous source in the pairing between a new advisory network tie and an entrepreneur, it is difficult to disentangle these often endogenous relationships. Even if we find evidence that the social network of the founder can affect entrepreneurial performance, it is difficult to determine how it facilitates the process precisely because we cannot observe it. If the venture strategy that an entrepreneur adopts could mediate the effect of network ties, observing this process could help explain the heterogeneous performance effect of social networks as well as different venture strategies.

Online entrepreneurship education offers a way to make progress on these research challenges by offering a unique research setting to conduct randomized field experiments and observe the process of entrepreneurship. Through class assignments on finding mentors, we randomize the way that students are taught to find a suitable mentor and test the outcomes for student entrepreneurs in the course. Through this experiment, we can also examine whether it is possible to alter social networks that could provide entrepreneurs with performance advantages in the earliest stages of venture formation. Our setting is an entrepreneurial class taught on NovoEd.com, a MOOC platform primarily designed to foster entrepreneurial education. We conducted a randomized field experiment using an entrepreneurship class taught as a MOOC. Since MOOCs can potentially reach thousands of students, it is an attractive setting for experiments designed to understand how one becomes an entrepreneur. An advantage of using MOOCs to collect data is that it allows a randomized experiment that is easily repeatable and verifiable because the software infrastructure does not need to be built specifically for the experiment. Another advantage is that, unlike using MBA students or undergraduate students from a particular university, we can get closer to a uniformly-distributed sample of the world's potential entrepreneurs. The students on the platform speak sixty-one different languages, come from more than 100 different countries, and from a wide range of ages and education levels.

Specifically, our randomized experimental design focuses on manipulating the course content. This is the first randomized, controlled field experiment on advisory social network ties and strategic processes that we are aware of. We created several versions of the same assignment that aims to help students find mentors and in guiding the strategic process. Comparing the outcomes before and after the mentoring assignment can help us understand better the micro-processes of early stage venture performance.

The MOOC on technology entrepreneurship was conducted in the fall of 2013. Enrollment was open for free to anyone via the Internet platform, NovoEd. Awareness of the upcoming course spread through social media and also through distribution lists of previous online courses offered by the university and by the platform. Students were advised that they need not have an entrepreneurial idea to begin the course and were also encouraged to sign up with a team or individually. Using a process that was similar for recruiting students, mentors were also recruited to sign up for the class. Once registered, each student and mentor created a profile page that includes biographical and work experience information.

The platform allows for students and mentors to search for one another using keywords and other profile information and to message each other. The class consists of a series of video lectures alongside seven assignments, which culminate in a final project called the opportunity analysis project. The class covers the early stages of entrepreneurship and strategy formulation, including forming a team, finding an opportunity, creating a business model as well as a prototype/beta version, and evaluating that opportunity based on qualitative and quantitative market analysis and customer interviews. The final project summarizes the team's work over the previous seven weeks in written and presentation form and evaluates whether their chosen entrepreneurial opportunity is worth pursuing as a startup.

Our goal is to not only understand whether certain network ties affect performance but also to understand how the entrepreneurial processes mediate the effect. The nature of the task, in our case, the strategic process in entrepreneurial firms, is likely to influence the impact of diverse ties that their mentors possess. Thus, there are two dimensions that we explore: first, planning vs. adaptive strategic approaches; second, diverse vs. non-diverse networks. We recorded the final grade for each student as well as whether a student has found a mentor. Due to

the large number of students, the grading for the class was done by peer review. Prior work and a meta-analysis show a strong correlation (0.69) between peer grading and instructor grading. This indicates that peer evaluation is a reliable and valid assessment, especially when averaging five or more peer-assigned grades on one project (Bouzidi & Jaillet, 2009; Cho et al. 2006; Freeman and Parks, 2010; Falchikov & Goldfinch, 2000; Sadler & Good, 2006). To prepare students to do the peer grading, they are given detailed grading criteria from the instructor and then trained on a set of five assignments that the instructor had previously graded. Students then grade five submissions before they could see their own scores and feedback. The peer evaluation scores are then averaged to generate the score for the final project. We then analyze the data and see how different factors (diverse vs. similar network, planning vs. adaptive strategy and their combination) affect the final project quality.

Experimental Procedures and Assessment

We created an assignment designed to help guide the strategic process and the type of mentor to recruit. We randomized the students into four different groups, with each group given a slightly modified instruction on finding a mentor.³ The students receive exactly the same assignment (the fourth out of eight) except those in the treatment groups receive an extra paragraph describing the type of mentor they should find and the approach (planning or adaptive) to the strategic process. Students are then evaluated not only on whether they find a mentor but also on the type of mentor. The four randomized groups are listed in Table 1.

The main variations introduced to the treatments are along two dimensions: first, planning vs. adaptive strategic approaches, second, mentor ties that generate diverse vs. non-diverse networks. Thus, one of the treatment dimensions is to show students the benefit of

³ Participants could find mentors either from those available on the platform or they could find someone in their local community.

having a mentor whose network connections are diverse and different from those of the students' network connections. Through this process, students can be primed to look for a mentor whose connections are diverse and different from their own. The second dimension is the type of strategy formulation process a student can choose to follow. In the planning process, a student is asked to have an unwavering vision about the business venture and when choosing a mentor, he should find someone who can support that vision. On the other hand, the adaptive process asks a student to adopt a more flexible approach to entrepreneurship. When seeking a mentor, a student is encouraged to be flexible and open to changes in the business model and to find someone who can co-create the idea and the implementation as well as determine the strategy of the venture with the student. The two variations in each dimension generate 4 treatment groups (Table 1).

Except for the randomized assignment, all the students receive exactly the same course content.⁴ Other than the extra 1-2 paragraph describing the type of strategic process and type of mentor, the rest of the assignment is the same for everyone. The 4 different versions of the assignments are listed in Appendix A. Mentors received a brief description of the class and were told that successful mentor relationships in the course involved meeting with the mentees at least three times and being available by email or phone to answer questions.⁵ Student surveys of the author's in-person version of the class indicates that students commonly report that their mentors helped them via feedback on their startup idea, communicating their experiences in industry and through facilitating introductions to others in their networks.

Two years after the class was completed, we sent a follow-up survey to all students who had enrolled. The survey asked whether they were still working on the same startup from the

⁴ This content includes the course videos, course websites, other homework assignments, and class forums.

⁵ They were told that we are trying to teach the participants how to think (e.g., about analyzing an opportunity), rather than doing the work for them. They were asked to guide and challenge the team, to help them think through the idea, to share experiences with them, to help them to network and to aid them in talking with potential customers.

class or not or whether they were working on a new startup. If they responded yes to either of these questions, we gathered data on the product launches, financial performance (revenues and funding) and survival of the ventures.

Data

We have a complete record of 942 students who completed the class out of 15,414 students enrolled. The summary statistics about these students are shown in Table 2. Of the entire 15,414 students, 19.7% of the students use English as their first language and the mean age for the group is in the early thirties. We also find that the vast majority of the students are male (74%). The median age for the group is in their twenties, and most hold a bachelor's degree. Among those who completed the class, more than half use English as their first language and the average age is between 30-35. Half are located outside of the United States with India being the second most frequent country of residence followed by Russia. These demographics are typical for online entrepreneurial classes at NovoEd.

Follow-Up Survey

As mentioned, we conducted a follow-up survey two years after the completion of the class to understand the long-term impact. We received responses back from 554 alumni out of those who had started the course, representing a 6 percent response rate (relative to the number who opened the email). Of these, 363 contained complete data on all of the variables needed for our base regressions. Importantly, the response rates were similar across the randomized groups. Among the four combinations, we would expect that each would comprise 25 percent of the sample. In our sample, the range was from 23.3 percent (diverse mentor group) to 27.8 percent (adaptive group).

Dependent Variables

We examine how teaching different strategic processes can generate early-stage outcomes in entrepreneurship. To assess these outcomes, we collected detailed records of students' assignment grades, class engagement activities, and their final project grade on the presentation of the entrepreneurial opportunity and business model. This final assignment is not a business plan, but is a final presentation and short written document that covers the problem, a prototype of the solution, analysis of the market size, customer interviews, finances, and business model. Thus, the planning and the adaptive approach had equal likelihood of favorable scores, and all participants had access to the evaluation criteria at the beginning of the assignment. Since the peer evaluation process randomly allocates five to ten other students to evaluate each submission, on average students were evaluated by equal numbers of peers who had received randomization to the planning and adaptive approaches. The earlier assignments include finding mentors, co-founders and teammates; identifying the market opportunity for the business and testing the value proposition with potential customers; creating an initial business model for how to generate revenue and a test for the business model's assumptions; and identifying common attributes of successful startups. All groups received the same assignments other than the one which we randomized. These earlier assignments are designed to help students complete the business model and the final presentation. Thus, student performance on the final startup presentation assignment is a salient measure of early stage outcomes. Delmar and Shane (2003) show that entrepreneurs who went through a higher number of the same steps that our final assignment covers, such as 'has the venture gathered information about the market and competition?' and 'have financial projections been developed?' were more likely to survive, develop a product, file the paperwork, and purchase equipment to actually start a firm. In contrast to their work, our experimental design allows us to examine two different approaches to

the business planning and strategic formulation process – one that is more adaptive and one that is driven more by a sustained vision. Thus, the completeness of activities very similar to our final assignment has been shown to be associated with important entrepreneurial outcomes. Decision heuristics have been shown to accurately predict subsequent outcomes for early-stage ventures (Åstebro and Elhedhli (2006).

While a high peer evaluation does not necessarily entail that the venture will ultimately perform well, it is one indicator that customers, investors, and employees may also believe that the venture is promising. At the early stages of a startup, a key goal is to convince potential cofounders, early employees, users and investors that the venture is an exciting and potentially viable opportunity. Peer evaluations of the final assignment's quality are thus a highly relevant measure. Entrepreneurs who receive a high peer score are likely to have an easier time gathering the initial resources (teammates, users, investors) compared to those who are ranked poorly by peers or who failed to complete these initial steps to validate the potential market opportunity. We do not observe whether the individual eventually becomes a successful entrepreneur (which may take a decade or longer). However, whether he has completed a final presentation on the startup opportunity and his performance on this presentation, which is meant to convince others that he has a viable business opportunity, gives us some indication of the likelihood that the venture will be a high performing one in the future. Thus, we use the grade in the final startup presentation as the main outcome metric. We then supplement this outcome with a survey conducted 2 years after the class to evaluate longer-term outcomes. The project could be done either in a team or by a single person. When there are multiple people on the team, each team member also receives an individualized grade that is determined by both the team score as well as an independent user score. The team score assesses the project quality; and the user score

assesses the individual contribution to the project. In addition to the project grades, we also calculated the final grade of each person for the entire class. The final grade and the project grade are highly correlated and our results do not differ when using the final grade of the class.

A specific set of evaluation criteria was provided to judge the startups. As an example, a high scoring project would have earned points for the following attributes: customer interviews, customer survey, and market-size analysis. The customer interviews included points for the following: a description of the insights gained into consumers' value and features that they need, and a description of how customers currently solve this problem or need. The survey included one to four points according to whether a team included a survey of potential customers, whether the survey was informative for their startup idea or whether it merely reconfirmed their beliefs. The market analysis included points for estimating the market size of the correct market, whether it was informed by their customer interviews and survey, whether they gave consideration to the target market, and whether the team estimated the market size in dollars and had an awareness of whether the market size was small or large. The scale is included in Appendix B.

Independent Variables. We also examine the likelihood of a student finding a diverse or non-diverse mentor. It is an important metric linking the randomized manipulation to the final class grades. After the assignment was due, we recorded whether a person had found a mentor and the type of mentor they found. These measures can help to assess the immediate outcomes of the randomized experiment, testing whether our randomized treatment has its intended effect. We conducted a survey a few weeks after the mentoring assignment. In the survey, we ask the students to rate whether their mentor has improved their network diversity as well as if they adopted a planning or an adaptive approach to entrepreneurship. The scale for measuring the diversity of the mentor's network is between 0 and 1, with 1 signifying that the mentor's network

is significantly diverse and different from that of the mentee and 0 meaning that the mentor's network is very similar. We ask the student to rate on a scale of 1-9 the extent to which he has chosen an adaptive approach to entrepreneurship, with 1-4 being more toward the planning approach, 5, being a mixed strategy, and 6-9 being more toward the adaptive approach. Thus, we created a binary variable of 1 to measure the adaptive approach if the student scored above 6.

Controls. Since the participants are randomized and the characteristics of the randomized groups are not statistically different (Table 2), control variables are not required. In a robustness test, we include several control variables and verify that the results still hold. *English* is a binary variable indicating if English is the primary language. *Male* is a binary variable indicating if the student is male. *Age* is grouped into four categories: 1 if the person is less than 25 years old; 2 if the person is between 25 and 35, 3 if the student is between 35-50, and 4 if the person is older than 50. The *earlier grade* is based on an earlier assignment before the randomization had occurred. *Completed course* is a binary variable indicating that the individual completed the course. *Disclose age* is a binary variable indicating that the individual provided age data.

Results

First, to ensure our randomization worked, we provide the summary statistics of the students for each of the four randomized groups (Table 2, Panel B). The groups have similar averages in speaking English as the primary language, age and gender. We also compared the grades of a prior assignment before the experiment and find that the groups have similar scores. These results suggest that our randomization worked.

We then examine whether our treatment conditions had the desired effect (Appendix Table C). Shortly after the mentor assignment was due, we asked the student as well as the peer graders about whether a mentor was found, and if so what type of mentor. We also asked the

students to describe how they pitched the idea to the mentor, specifically whether they chose to pitch their vision or plan or whether they chose to be adaptive and co-create the idea with the mentor. We use these responses as the primary intermediate outcome to ensure whether the treatments had the desired effects. Students in diverse treatment groups (Diverse Planning and Diverse Adaptive) have an increased probability of finding a mentor who can improve the students' own network diversity, about an additional 5.3 percentage points. A student who learned the adaptive approach to entrepreneurship (Adaptive only and Diverse Adaptive) was more likely to be adaptive than one in the planning treatment group. We also used a Heckman selection model to address missing data from non-responses and observed results similar to the OLS model. These results suggest that our treatment worked.

Next, we examine whether the randomization affects the outcome we are interested in: student engagement and final outcome of the startup presentations. In Table 3, we first examine how the different treatment groups affect the likelihood of completing the class. In our setting, less than 20% of the students completed at least one assignment, and less than half of these students actually completed the class.

While our treatment groups were not primarily designed to increase retention, we did observe differences in the class completion rate among the 4 groups. Specifically, we observe a slight uptick in retention for the students in the planning group; they are 1.3 percent more likely to complete the class compared to students following adaptive processes (Column 1 of Table 3). Perhaps, a clear vision of the business model helps in motivating students, and as the result, they are more likely to continue engaging in class. To ensure that the treatment effect we found was not a fluke, we compared the grades of an earlier assignment before our randomized experiment. We show in Column 2 that there should be no treatment effect and all the groups have a similar

outcome for the earlier assignment. This again indicates that our randomization worked and our observed effect on later outcomes was causal.

We then explore whether the randomized treatment has an effect on students' final startup presentations, which has been shown to be correlated with venture performance (Delmar and Shane, 2003). As shown in Column 3 of Table 3, we observe that the planning-only group received a higher score on average than the students in the adaptive-only group, by about 0.552 points or a 2.1 percentage improvement. However, we find that the disadvantage of using an adaptive process can be mitigated through finding the right type of mentor. As shown in Column 4 that includes demographics controls, pairing with a mentor who can improve a founder's network diversity can erase most of the disadvantage of using an adaptive process. Students in the diverse adaptive group receive an additional 0.538 points compared to the adaptive only group and this increase essentially eliminated the advantage enjoyed by the planning group. However, finding a mentor with diverse network connections does not seem to confer additional benefits to the planning group because the outcomes between planning and diverse planning groups are essentially same (we cannot reject the null that the two estimates are different). These results are graphically shown in Figure 1 as well. The adaptive group performed the worst. But, when they are primed to also find a mentor with diverse network connections, the adaptive diverse group performed similarly to the planning and diverse planning groups.

Only 942 students responded to our assignment about the type of mentor and entrepreneurial process they eventually used. The high attrition rate can create a selection bias because we cannot observe the outcomes of the students who dropped the class. To address this bias, we use Heckman's selection model that is specifically geared toward solving the truncation problems by approximating the potential outcomes that these dropouts would have received. We

use a variable, the number of days a user has spent on the NovoEd platform before the class, to approximate student retention. Presumably, those students who have consistently used the NovoEd platform are more likely to complete another NovoEd class than those who are new to it. At the same time, the number of days spent on NovoEd prior to the class should not directly affect the quality of their startup presentation. We find the number of days spent on NovoEd prior to the class has a positive effect on retention in the first stage and thus it can help address the potential selection problem arise from attrition. In Columns 5-8 of Table 3, we repeated the analysis using the Heckman selection model and these results are largely similar to the earlier analysis. We find that the adaptive approach is inferior to the planning approach. However, we also find that a mentor with high network diversity can mitigate the difference. In Column 6 of Table 3, we also included demographic controls such as age, gender and primary language spoken. These additional controls did not change our results. Both the magnitude and the direction of the estimates are similar to the reported results in Column 4. We then extend the Heckman analysis on the effect for the earlier outcomes. As shown in Column 7-8, none of the treatment groups has a statistically significant effect on the outcomes of an earlier assignment. As expected, there should not be any treatment effect on outcomes prior to the treatment itself.

Overall, these results suggest that finding key resources such as mentors requires a correct matching between the type of mentor and the type of entrepreneurial process. If the entrepreneur chooses a planning strategy, finding a mentor with diverse network connections would not necessarily help. As long as a mentor can support the vision, the entrepreneur benefits regardless of whether the mentor has network diversity. By contrast, if the entrepreneur chooses an adaptive strategy and is willing to co-create a vision with the mentor, then having a mentor with diverse networks is beneficial. Because the information and resources provided by a mentor

with diverse network connections can aid an entrepreneur in finding new opportunities, the entrepreneur using an adaptive approach is more likely to seize the opportunity and more willing to use the information to form strategies. Also, if customer or market feedback indicates that the venture should change strategies and move in a different direction, it is more likely that the mentor may have connections that could help make the change. An entrepreneur following the adaptive process could be more willing to use these resources even if these resources deviate from his original vision. However, following the adaptive strategy alone can actually affect early-stage entrepreneurial outcomes negatively.

Follow-up Survey Results

Results from our follow-up survey indicate that 46.7 percent of the respondents were still working (either part-time or full-time) on a startup idea based on or related to what they worked on in the class. While this may be a high percentage, we do not know what proportion of these respondents were working on it part-time versus full-time.⁶ Of those who were not working on a startup based-on the course, 49.4 percent of these alumni reported working (part-time or full-time) on a new startup.

Our regression results in Table 4 show that the participants who had been randomized to the adaptive only or the adaptive diverse groups have significantly higher revenues (Model 1) and external funding raised (Model 2) in their ventures two years after the end of the class.⁷ Overall, our randomization appears to have a lasting influence, yet the results are different from the early-stage results obtained at the end of the class. Columns 3-5 of Table 4 use diverse planning as the baseline group and show the results of our Heckman regression, using time spent

⁶ In addition, many students signed up for the class because they expressed interest in an entrepreneurship course, so we should expect that a higher proportion of them than the general population are seeking to actively work on startup projects.

⁷ The results are also robust to using the months of survival as the outcome measure.

on the NovoEd site prior to the course as the predictor for responding to the survey. Model 3 finds that the diverse adaptive and adaptive only groups had significantly higher revenues than the diverse planning group. The coefficient is larger for the diverse adaptive group, while the difference with the adaptive group is not statistically significant. Model 4 indicates that the adaptive only group raised significantly more external funding than the diverse planning group. Model 5 shows that the diverse adaptive group is significantly more likely to have created a new startup on an idea that is not based on the idea that they started with in the course. This suggests that this group was more open to changing their idea, even to the point of creating a brand new startup. Looking across Table 4, the evidence is suggestive that the diverse adaptive group appears to have better performance relative to the adaptive group and the evidence is strong that the adaptive approach does better than either of the two planning groups. Examining Table 3 and Table 4 together, we show that while the planning approach is better than the adaptive approach in the early stages, having high network diversity can mitigate the disadvantages of the adaptive approach. In fact, the advantage of being in the diverse adaptive group persists in venture outcomes two years afterward and it is the only group that consistently outperforms others.

Limitations and Future Research. Interpreting the implications of these results should be done in light of the limitations of our research context. We do not claim that the evidence presented here is definitive and we acknowledge that our results are specific to the early stage of venture formation and to ventures created from exercises in an online course context. We examine one setting (an entrepreneurship online course) with two randomized interventions; and it is focused on potential entrepreneurs and ventures at the early stage. While the project areas range from biotech to software, many of the venture ideas relate to internet, mobile and software-based ventures. Another open question is whether the pattern of results that we find is due to the

fact that many who sign up for online classes are relatively inexperienced, first-time entrepreneurs. Would mentors simply matter less for an experienced set of founders? Would adaptive vs planning matter less as well? Future research should examine these limitations, which represent areas that are ripe for further theorizing and data collection. Such potential research questions building on this line of work include the extent to which the findings extend to later stage ventures, how to optimize early peer evaluations to better predict future venture outcomes such as fundraising, product release or growth, and finally any important industry or institutional context contingencies.⁸ The power of the randomization along with the fact that our data spans thousands of individuals in many countries and industries provides reassurance that the results may apply beyond this setting. While our research design has its limitations, it makes progress in disentangling the endogenous matching process between individuals, social network ties and strategy. We are hopeful that the structure and repeatability of our experiment will spur future research in this direction using similar research designs in this and other contexts.

Conclusion and Discussion

Despite literature on social network theory and the social networks of entrepreneurs, we know relatively little about whether such externally introduced changes in social network ties produce their intended outcomes. We use a randomized, controlled field experiment to examine whether the strategic process influences the outcomes of the early stages of entrepreneurship. By using a training intervention in the form of an assignment during a MOOC, we show that the type of strategic process the entrepreneur benefits from the most depends in part on the type of network the mentor had that the entrepreneur developed a tie with. Overall, we find that the adaptive only group performs the worst in our experiment at the earliest stage, while groups who

⁸ Peer-evaluations were randomized. Future research may examine whether individuals randomized to different conditions completed peer-evaluations in a systematically different way.

use a planning process without a diverse mentor obtain comparatively better grades on their final startup presentations. However, the adaptive process is not entirely bad. We also find that entrepreneurs who work with mentors with diverse networks and also adopt adaptive processes do significantly better as well. Two years after the class ended, entrepreneurs who had taken the adaptive approach did significantly better in terms of financial outcomes, particularly those with a diverse mentor. These results suggest that more structure may be better at the earliest stages of venture formation, yet for longer-term financial outcomes it is important to remain adaptive and avoid inertia (Davis, Eisenhardt and Bingham, 2009). Further, venture performance requires a correct match between the type of mentor and the type of entrepreneurial process. The information and points of view that a mentor with a diverse network can provide can be very helpful to the adaptive entrepreneur. By contrast, entrepreneurs choosing a planning approach would not necessarily benefit from having a mentor with high network diversity.

Contribution to the literature on firm strategy and entrepreneurship

Literature at the intersection of strategy and entrepreneurship has raised the idea that strategic planning may not be the optimal mode of strategy formulation (Mintzberg, 1990; 1994). Adaptive, discovery-driven strategic processes have been proposed as being more appropriate alternatives to strategic planning in high velocity, uncertain and unstable strategic contexts such as starting a new venture (McGrath, 2010). Hiatt and Sine (2014) find that operational planning is helpful in unpredictable environments while strategic planning is not. Research in entrepreneurship has argued that adaptive processes of strategy making may have important advantages (Wiltbank et al., 2006). Entrepreneurs may use improvisation (Baker, Miner, & Eesley, 2003), bricolage (Baker & Nelson, 2005), and effectuation (all various forms of adaptive strategies) to gather resources and create value (Sarasvathy, 2001). Brown and Eisenhardt (1997)

show that continuous change using semi-structures and sequenced steps is preferable to planning or simply reacting to industry developments. Recent developments in strategy emphasize a similar concept of dynamic capabilities (Eisenhardt & Martin, 2000; Teece, 2007).

However, relatively little work examines the question of how the strategy making process interacts with social network ties. Our paper contributes to this work by showing that adoption of a more adaptive strategic process can actually be harmful to the venture if it is not combined with diverse network ties. In fact, a more planning oriented approach of having a strong vision is usually better at the early stages than an adaptive approach alone. This finding is in contrast to prior work that has argued for the advantages of a more adaptive strategy-making approach for ventures. However, it is consistent with prior simulation-based work that identifies the downsides of too little formalism in organizations and suggests that entrepreneurial firms may benefit from adding structure (Davis, Eisenhardt, & Bingham, 2009). A two-year follow-up indicates that the planning approach is inferior at that stage and the adaptive approach, particularly when coupled with a diverse mentor performs better.

Contribution to social network theory

Contrary to prior work that has argued that social networks are resistant to change due to history, personality and past actions (Powell & Grodal, 2005), we find that a relatively short educational intervention and interaction with a new mentor network tie has a positive measurable effect on project outcomes. However, to capture the benefits of the social network tie, an individual must use the appropriate strategic process. By prompting a change in network formation, we find evidence of a causal relationship between having a mentor with a diverse network and an increase in the performance benefits of an adaptive strategic process.

We contribute to recent literature that has sought to better causally identify social network effects (Wu 2013; Azoulay, Stuart & Wang, 2013; Feldman et al., working paper). Our findings suggest that the standard approach to estimating the impact of a diverse social network may either over- or under-estimate its value depending on the context. Since network formation is endogenous, existing literature may be overestimating the network effect given that higher “quality” individuals likely match with certain network ties. If the sample is made up of individuals who largely take a planning approach, then existing literature may underestimate the benefits of diverse network ties for individuals who adopt a more adaptive strategic approach.

Prior literature on social networks shows that their structure has an important influence on work performance (Burt, 1992; Wu, 2013), including in entrepreneurship (Aldrich & Kim, 2007; Stuart & Sorenson, 2005, 2007). However, previous research has not considered whether the task or the type of strategic process impacts the benefits from social network ties. Furthermore, the endogenous matching process between individuals and the choice of strategy have previously confounded efforts to determine the best ways to approach and work with additional network relationships. Our study takes a step forward in ameliorating these specific challenges through a novel experimental methodology using an online course.

We contribute to research on the strategic value of networks. Our findings complement a growing stream of recent work which outlines the conditions under which different types of networks are most valuable. For instance, direct and indirect social network ties to investors have been shown to increase the likelihood of raising investment resources (Stuart & Sorenson, 2005) due to the status that is reflected in network ties (Stuart and Cable, 2002). In addition, we know that for ventures undergoing an initial public offering (IPO) the value of inter-organizational ties to venture capital firms and investment banks is contingent on the state of the market (Gulati &

Higgins, 2003). Vissa and Chacar (2009) find that team demographics and social networks jointly shape an entrepreneur's performance outcomes. Hite and Hesterly (2001) argue for a life cycle model, where initially firms have a dense, cohesive, closed network and gradually evolve towards networks with more structural holes and networks based on economic calculations. Our findings suggest that a venture's strategic process must be taken into account and that the adaptive process would not benefit from a dense, cohesive, closed network, at least not at the earliest stages.

Policymakers and educators are designing many institutions, policies and programs aimed at altering and improving the training and social networks of aspiring entrepreneurs and innovators (Bruneel, Ratinho, Clarysse, & Groen, 2012).⁹ Literature on the strategy formulation process and altering the process through training has been limited largely because of the difficulty in observing micro processes and in determining causality from observational data. Our research design is among the first randomized controlled trials (RCTs) that we are aware of that overcomes certain limitations by using a randomized intervention in a MOOC to gather data through a novel research design.

Our results also have important implications for policymakers, managers of accelerator programs and educators seeking to influence an entrepreneur's social networks or train entrepreneurs in strategic processes. The findings from our study indicate that such programs may actually harm entrepreneurs and their ventures if these programs and policies neglect the central insights of our findings and uncritically encourage entrepreneurs and managers to build diverse network connections or, separately, to uncritically follow more adaptive and flexible approaches to building ventures. Adaptive strategic processes need to be paired with social network ties with diverse connections to reach their full potential. A strategy that encourages

⁹ https://www.nsf.gov/news/special_reports/i-corps/, accessed March 13, 2016.

entrepreneurs to create a strong vision and use more planning processes may be more reliable as it performs well at the early stage regardless of the social network ties of the entrepreneur.

This paper presents a novel research design that enables a test of the hypothesis that the value of a more planned versus a more flexible strategy formulation process is shaped by the social network ties of the founding team. Understanding how the process of entrepreneurship and how social capital complements or substitutes these effects requires more exploration. Given that many policymakers and incubators teach the adaptive approach to pursuing a venture and pair student entrepreneurs with mentors, it is critical to causally establish whether and under what conditions these strategies can actually improve entrepreneurial outcomes. We examine the interplay between the strategic process of entrepreneurship and having mentors who can introduce diverse resources at the earliest stage of forming a venture. Contrary to the notion that the adaptive process is more beneficial, we find the planning approach to be superior at the earliest stage. However, a mentor with diverse social networks can mitigate the disadvantage of using the adaptive approach. Two years into the startup process, outcomes are significantly better for the adaptive approach, particularly when combined with a tie to a more diverse network.

Overall, we are encouraged to see the power of randomized assignments on MOOCs to understand the process of strategy and entrepreneurship in ways that challenge observational studies. By simply modifying the wording of a class assignment, we are able to introduce meaningful changes in early-stage venture outcomes. Furthermore, our experimental design can easily incorporate other types of treatments, and verify findings. Similar to how social media has transformed many aspects of social science research, MOOCs, as shown in our study, can also be used as a rich experimental test bed for understanding the causal impact and mechanisms of many strategic and business processes that were previously difficult to observe.

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Table 1: Description of Randomized Groups		
	Do not need to find a mentor with a diverse network	Find a mentor with a diverse network
Adaptive Approach	Group 1: Adaptive Only Logics. Describe the general idea of the business concept and be open to considering alternative solutions and ideas from the mentor.	Group 2: Diverse Mentor & Adaptive Logics. Describe potential benefits of having a mentor with diverse social ties. When you come across such a mentor, pitch your business idea and be open to considering alternative solutions and ideas. Ask the mentor to provide resources to help you co-create the project.
Planning Approach	Group 3: Planning Only Logics. Describe your vision of the business. Find a mentor who shares and agree with your vision and solutions. Ask the mentor to help guide you to build a product or service according to the vision.	Group 4: Diverse Mentor & Planning Logics Describe potential benefits of having a mentor with diverse social ties. When you come across such a mentor, pitch your vision and see if the mentor shares and agrees with your vision. Ask the mentor to provide resources to help you realize the vision.

Table 2: Panel A: Summary Statistics					
Variable	Obs.	Mean	Std. Dev.	Min	Max
Age	15414	0.639	1.026	0	4
English	15414	0.197	0.398	0	1
Female	15414	0.363	0.481	0	1
Completed Course	15414	0.109	0.312	0	1
Final Grades	941	11.648	2.867	3.288	19.499
Panel B: Summary Statistics by Randomized Group					
	Obs.	English	Male	Age	Earlier Grades
Adaptive	3855	0.197 (0.398)	0.360 (0.480)	0.637 (1.020)	16.495 (3.104)
Diverse Adaptive	3859	0.196 (0.397)	0.351 (0.477)	0.615 (1.005)	16.420 (3.215)
Diverse Vision	3849	0.203 (0.402)	0.369 (0.483)	0.650 (1.038)	16.675 (3.203)
Vision	3851	0.194 (0.395)	0.373 (0.484)	0.655 (1.042)	16.615 (3.150)

Note: Student demographics: English is a binary variable indicating if English is the primary language. Male is a binary variable indicating if the student is male. Age is grouped into four categories: 1 if the person is less than 25 years old; 2 if the person is between 25 and 35, 3 if the student is between 35-50, and 4 if the person is older than 50. The final grade is out of 24 points. The earlier grade is based on an earlier assignment before the randomization had occurred.

Table 3: The Treatment Effect on the Final Startup Presentation

Dep. Var.	(1) Completed Class	(2) Earlier Grade	(3) Final Grade	(4) Final Grade	(5) Final Grade	(6) Final Grade	(7) Earlier Grade	(8) Earlier Grade
Diverse	0.006	-0.048	0.444	0.538**	0.550**	0.509*	-0.068	-0.066
Adaptive	(0.008)	(0.154)	(0.272)	(0.248)	(0.274)	(0.272)	(0.156)	(0.156)
Diverse	0.006	0.175	0.516**	0.483*	0.573**	0.524**	0.176	0.184
Planning	(0.008)	(0.154)	(0.256)	(0.259)	(0.265)	(0.264)	(0.156)	(0.156)
Planning	0.013*	0.126	0.552*	0.673**	0.582*	0.591*	0.088	0.108
Only	(0.008)	(0.153)	(0.305)	(0.311)	(0.302)	(0.307)	(0.155)	(0.155)
English		0.112		0.185		0.049		-0.159
		(0.124)		(0.237)		(0.258)		(0.128)
Male		-0.066		-0.352		-0.427		-0.253*
		(0.157)		(0.240)		(0.263)		(0.136)
Age		0.308***		0.136		0.002		-0.032
		(0.065)		(0.123)		(0.151)		(0.072)
Disclose		0.309		0.987**		0.543		-0.432
Age		(0.378)		(0.450)		(0.488)		(0.397)
Earlier Grades				0.102**				
				(0.042)				
Constant	0.133***	16.105***	11.283***	7.312***	12.767***	13.082***	18.144***	18.174***
	(0.00547)	(0.215)	(0.288)	(0.839)	(0.387)	(0.797)	(0.163)	(0.284)
Obs.	15,414	3,324	942	942	15,414	15,414	15,414	15,414
Rho					-0.333	-0.383	-0.474	-0.420
Lambda					-0.993	-1.151	-1.465	-1.384
Sigma					2.984	3.003	3.315	3.294
R-Square	0.001	0.012	0.032	0.132				

Note: Regressions of student outcomes against the 4 randomization-groupings. Clustered standard errors are in parenthesis. Column 1 shows whether the student has completed the class. Column 2 is a manipulation check, showing that the effect of the randomization should be zero on assignment grades before the treatments took place. Columns 3-4 shows the effect of the randomization on the final project grades. Columns 5-8 are Heckman selection models, regressing student outcomes against the 4 randomization-groupings. Clustered standard errors are in parenthesis. Columns 5-6 show the effect of the randomization on the final project grades. Columns 7-8 are a manipulation check, showing that the effect of the randomization should be zero on assignment grades before the treatments took place.

*** p<0.01, ** p<0.05, * p<0.1

Table 4 The Treatment Effect on Venture Outcomes					
Dep. Var.	(1) Revenues	(2) Funding	(3) Revenues	(4) Funding	(5) New Startup
<i>Adaptive & Div. Adaptive</i>	14.92** (7.066)	14.81** (7.351)			
Adaptive Only			18.71* (10.06)	21.49** (10.25)	0.0336 (0.075)
Planning Only			11.48 (11.60)	5.464 (11.43)	0.0197 (0.077)
Diverse Adaptive			23.33** (10.88)	9.861 (11.91)	0.161** (0.078)
English	-16.04** (8.008)	-6.462 (7.921)	-17.44** (8.789)	-6.578 (8.521)	-0.149** (0.062)
Male	-3.047 (7.687)	-1.220 (8.163)	-3.098 (9.067)	0.729 (9.077)	-0.076 (0.066)
Age	1.650 (3.234)	-2.468 (2.995)	3.077 (7.877)	-2.779 (6.668)	-0.030 (0.034)
Disclose Age	-11.90 (8.258)	-1.139 (25.04)	-13.11 (27.46)	-0.105 (28.24)	-0.128 (0.155)
Constant	22.33*** (6.228)	29.02*** (7.346)	1.469 (92.14)	20.15 (88.44)	1.856*** (0.303)
Obs.	88	88	15,414	15,347	15,414
R-square	0.099	0.071			

Note: Regressions of student outcomes against the 4 randomization-groupings.

Clustered standard errors are in parenthesis. We use the Heckman selection model to correct the biases that arise from survey response rates (Models 3-5).

*** p<0.01, ** p<0.05, * p<0.1

Figure 1: Final grades by treatment groups

