

Addressing the youth skills gap through university curricula: Evidence from a quasi-experimental evaluation in Rwanda

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January 6, 2020

Youth unemployment and underemployment rates in Sub-Saharan Africa are among the highest in the world. One frequently cited culprit is the gap between the skills needed in the labor market and the skills that youth have when they enter the labor force. While a common approach to addressing this gap is standalone technical and vocational education training (TVET), we examine an alternative model in Kigali, Rwanda, that involved redesigning university curricula around skills valued in the local labor market. Students in the Southern New Hampshire University (SNHU)-Kepler program received a combination of in-person instruction and online coursework in skills perceived to be in demand by local Rwandan employers. We used a quasi-experimental design to match the first two cohorts of SNHU-Kepler students, before they started their program in 2013 and 2014, with similar students starting at local universities at the same time and tracked the two groups post-graduation, 5 to 6 years after baseline. To identify comparable matches, we simulated the SNHU-Kepler admissions process, and we filtered out comparison students who had heard of SNHU-Kepler to reduce selection bias. We find that graduates of the SNHU-Kepler program performed better than their matched peers on skills prioritized by employers in the local labor market, including computer literacy, English language, and cognitive skills. SNHU-Kepler graduates in turn had better labor market outcomes, being twice as likely to be employed immediately after graduating, and securing jobs with higher salaries, longer hours, and written contracts. Comparison students appeared to eventually catch up to SNHU-Kepler students in terms of employment rates, but SNHU-Kepler students continued to earn twice as much and work 33% more hours as their matched peers several years post-graduation. While our study suggests that skills-based blended-learning university programs offers one potentially scalable model for bridging the skills gap among youth in sub-Saharan Africa, more research is needed to disentangle the relative contributions of curricular changes versus university career services.

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I. Introduction

Youth unemployment and underemployment rates in sub-Saharan Africa are among the highest in the world, with conditions projected to worsen. In some estimates, the region's working age population is expected to grow by 450 million people by 2035 (about 3% per year), whereas only 100 million new jobs are projected to be added in the region over that time (World Bank, 2017). Official unemployment rates, while high, often obscure the scope of the problem: the majority of youth are unable to access high-skilled, high-paying, full-time jobs. The region has the highest incidence of working youth in poverty, with nearly 69% of youth *who have jobs* living in poverty (less than US\$3.10 per day) and 35% living in extreme poverty (less than US\$1.90 per day) (International Labour Organization, 2017).

One frequently cited culprit of youth unemployment and underemployment in the region is a lack of high-skilled job market candidates, which deters employers from bringing high-skilled jobs to the local economy (British Council, 2014). Employers report that the youth labor pool in sub-Saharan Africa lacks key skills necessary in the modern economy, including IT skills, teamwork, and problem solving (*ibid*). When employers need to fill high-skilled technical and management positions locally, they often import labor from other regions, which further crowds the local youth job market (Filmer & Fox, 2014; Schendel 2013).

Governments have responded to this skills gap with large investments in Technical and Vocational Education and Training (TVET) programs. Between 2002-2012, the World Bank and client governments spent nearly \$1 billion annually on TVET programs (Blattman & Ralston, 2015). Despite this investment, TVET programs have rarely achieved the levels of success expected of them. In a recent literature review of rigorous evaluations of TVET programs, only 3 out of 9 evaluations found positive, significant effects (McKenzie, 2017). The average increase in employment levels across studies was 2.3 percentage points, though when asked to predict impact ex-ante, policymakers expected impact estimates to be 10x larger (*ibid*). Critics have cited high program attrition and high cost per participant as fundamental flaws in these programs (McKenzie, 2017; Cho, 2013). Due to these modest increases in employment, TVET programs are rarely cost-effective. Governments and donors spend \$17,000 to \$60,000 per person employed as a result of these programs (McKenzie, 2017).

An alternative approach to standalone TVET programs may involve overhauling curricula *within* universities to teach skills that are relevant for the local economy. While tertiary enrollment in sub-Saharan Africa is far from universal, it is rising rapidly, increasing from 4% in 2000 to over 9% in 2018 (UNESCO Institute for Statistics, 2019). However, the current curricula in Africa universities is widely perceived as failing to equip graduates with the skills desired in local labor markets (Arias, Evans & Santos, 2019), as it emphasizes memorization and rote learning over critical thinking, technical and professional skills (Filmer & Fox, 2014; Schendel, 2013). By incorporating skills training into degree programs, the levels of attrition that plague TVET programs may be mitigated, and substituting existing curricula for skills-based competencies may limit the additional costs often required for skills training. Some universities in higher-income countries have experimented with this approach to skills training, though limited research exists on the efficacy of these programs, and even less research has been done on the impact of these programs in African universities (Garret & Lurie, 2017).

We evaluate one attempt to address the youth skills gap through a skills-based university curriculum in Rwanda, where as many as 2 out of 3 youth are underemployed, and few youth obtain formal sector employment (YouthStart Global, 2015). In 2013 Kepler, an education non-profit based in Rwanda, partnered with Southern New Hampshire University (SNHU) to design a three-year program based around

perceived skills gaps of university graduates in Kigali. The curriculum, informed by feedback from local employers, focuses on building skills in English language, computer literacy, and problem-solving, as well as instructing graduates on content in career-specific fields. The program leverages a ‘blended learning’ model that pairs online lectures and course content with in-person instruction; in theory this model allows SNHU-Kepler to customize curricula to the specific skills gaps of their population and deliver it at a fraction of the cost of traditional class-based instruction. SNHU-Kepler combines this skills-based curriculum with support for students in building networks with employers through internship matching, hosting career events, and coaching students through the job search process.

We use quasi-experimental methods to match the first two cohorts of SNHU-Kepler students, in 2013 and 2014, with similar students starting at four local universities in Kigali at the same time. To minimize potential differences between SNHU-Kepler students and comparison students, we administered the same tests and screening criteria to potential comparison students as those used by SNHU-Kepler admissions staff to select SNHU-Kepler students, and filtered out students who did not pass SNHU-Kepler admission standards. To mitigate unobserved selection effects, we also excluded students who had heard about the SNHU-Kepler and opted not to apply. Finally, we matched remaining students in the comparison pool with SNHU-Kepler students on criteria that were likely to predict labor market outcomes, including prior education, socioeconomic status, and baseline skills test scores. Our identification strategy relies on the assumption that matching SNHU-Kepler students and students from the eligible comparison pool following this process yields a comparison group that plausibly resembles the baseline profile and trajectory of SNHU-Kepler students if they had not enrolled in the SNHU-Kepler program

We tracked and assessed students in our sample 1-3 years post-graduation in competencies in high demand in the Rwandan labor market, including computer literacy, English reading and writing, cognitive skills, and critical thinking. SNHU-Kepler graduates performed significantly better than matched comparison graduates on all assessments except for critical thinking. The differences in scores were large, particularly for computer literacy and English reading and writing: SNHU-Kepler graduates performed 1.82 standard deviations (SD) better than matched comparison graduates in computer literacy, 0.78 SD better in English reading, and 0.82 SD better in English writing.

SNHU-Kepler graduates in turn reported better labor market outcomes than matched comparison graduates. SNHU-Kepler graduates were twice as likely to be employed immediately after graduating than comparison graduates, and the jobs that they secured had higher salaries and more stable hours. While comparison graduates appeared to eventually catch up to SNHU-Kepler graduates in terms of employment rates, salary differences between the two groups continued to increase: at the time of our survey, 1-3 years after graduation, SNHU-Kepler graduates reported earning more than twice as much per month and working 33% more hours as their matched peers.

The results from this evaluation suggest that, as tertiary enrollment in sub-Saharan Africa grows, a skills-based blended learning model could be an effective policy solution to bridging the skills gap between young graduates and the labor market in sub-Saharan Africa. In the remainder of this paper we describe the SNHU-Kepler program model (Section II), our identification strategy and data collection process (Section III), and results (Section IV). In Section V we conclude with a discussion of policy implications, limitations of our study, and areas for further research.

II. Background and Description of the Program

In 2013, SNHU and Kepler partnered to design a university program to address youth unemployment and underemployment in the Rwandan labor market. From its early stages, the SNHU-Kepler program gathered feedback from local employers on what skills were needed in early professionals and what gaps they observed among university graduates in Rwanda. Using this feedback, the SNHU-Kepler program built a curriculum based on professional competencies intended to prepare students for the workforce. In contrast to the curricula taught by Rwandan universities, which focuses primarily on subject content, the SNHU-Kepler curriculum emphasizes career-relevant skills, such as English language, technology, and problem-solving skills, while also preparing graduates on content related to careers in specific fields, such as health, communications, or business.

In an effort to deliver high-quality content at a lower cost, SNHU-Kepler leverages a blended-learning approach. In the first six months of the program, students receive in-person instruction focused on English language skills and computer literacy. This foundation is meant to enable students to master subsequent online coursework independently, which students work through to complete their degree. Throughout the program, students have access to in-person academic support, study groups, and advising sessions at the campus in Kigali. Typically, students receive their Bachelor's degree after three years, or one year sooner than Bachelor's degree programs offered by most Rwandan universities.

As the program matured, SNHU-Kepler increased its emphasis on career services for students. Students are coached on networking and communicating professionally with employers. SNHU-Kepler also hosts network events where students can network with employers, and program staff can solicit feedback from employers on what is important to them in young professionals.

During the early years of the program, SNHU-Kepler largely relied on preexisting networks to advertise the program and recruit students. When candidates applied to the program, SNHU-Kepler screened applications on senior 6 marks (grades in the final year of high school), national exam scores (an exam taken by all seniors in high school), and 'Ubudehe' family poverty status designation. Applicants were administered an English test, math test, one-on-one oral exam, and one-on-one interviews. Students who passed the screening criteria and the admissions tests were offered a spot in the program. 50 students enrolled in the program in the first year, in 2013, followed by 88 students in 2014.

III. Methods and Data

To estimate the effects of the SNHU-Kepler program on skills development and labor market outcomes, we matched SNHU-Kepler students before they started their program with similar students starting at local universities in Kigali at the same time and tracked the two groups over the course of the evaluation. We identified students who would have had a high likelihood of enrolling in SNHU-Kepler if they had been aware of the program using selection criteria defined by the SNHU-Kepler admissions process and other characteristics such as prior education, socioeconomic status, and baseline skills test scores. Our identification strategy relies on the assumption that matching SNHU-Kepler students and students from the eligible comparison pool on these criteria (expressed as propensity scores) yields a comparison group that plausibly resembles the baseline profile and trajectory of SNHU-Kepler students if they had not enrolled in the SNHU-Kepler program. The main threats to the validity of our estimation strategy are (i) unobserved characteristics that are not accounted for in propensity scores that influence both a student's

likelihood of enrolling in SNHU-Kepler and post-graduation skills and labor market outcomes, and (ii) differential attrition of SNHU-Kepler and comparison students over the course of the evaluation. Below we describe how we mitigate, but do not fully resolve, each of these concerns, and the implications that these limitations have for interpreting our results.

Matching Design

Our SNHU-Kepler sample includes students who enrolled in the program during its first two years, 2013 and 2014. We followed slightly different procedures for identifying matched comparison students for each of these cohorts, described below.¹ In order to maximize statistical power our main specification pools these two cohorts; we also present cohort-wise results in Appendix A.

2013 cohort

We recruited comparison students from four universities in Kigali that we anticipated having students who were most comparable to SNHU-Kepler students, based on school ranking and academic discipline areas that were similar to the SNHU-Kepler program. After receiving permission from these universities, local research assistants went to public spaces on campuses to recruit students, and collected preliminary data on 532 students, including their standardized national examination scores (an exam taken by all seniors in high school), Senior 6 marks (grades in the final year of high school), sex, age, and 'Ubudehe' family poverty status designation. We collected these data since they are some of the criteria that SNHU-Kepler use in their student admission process. We excluded students that (i) scored below 85% of the minimum score of SNHU-Kepler students on the most frequently tested national exam subjects; (ii) scored below 70% of the minimum score of SNHU-Kepler students on all other national exam subjects; (iii) scored below 90% of the minimum Senior 6 marks of SNHU-Kepler students; (iv) were in a higher 'Ubudehe' poverty category than SNHU-Kepler students; and (v) were outside of the age range of SNHU-Kepler students.² This filtered list contained 200 prospective comparison students.

In October 2013, approximately one month after the start of the first academic year, we surveyed all 50 SNHU-Kepler students along with the 200 prospective comparison students who had passed the first round of screening. This survey covered more detailed information on students' family and parental background, poverty status, educational background, computer literacy, and career ambitions.³ Using survey data, we estimated propensity scores for each student by fitting a logistic model for whether the student was enrolled in SNHU-Kepler.⁴ We matched SNHU-Kepler students 1:2 (without replacement)

¹ We refined our matching process for the 2014 cohort as we had more information on the SNHU-Kepler recruitment and admissions process.

² We applied cutoffs for national exam scores and Senior 6 marks that were below the minimum SNHU-Kepler scores and marks in case some comparison students below those cutoffs were otherwise good matches for SNHU-Kepler students. In practice, the final matched sample for 2013 only contained 4 (4%) comparison students who scored below the minimum SNHU-Kepler student on the national exams and 0 students who had lower Senior 6 marks than the lowest SNHU-Kepler student.

³ We also administered skills assessments to SNHU-Kepler and comparison students. However, students were already one month into the semester, and on top of that SNHU-Kepler students had participated in a bridge program over the summer. Since these activities could plausibly have already affected scores on these assessments, we did not include them in the matching algorithm. For the next year's cohort, we timed the baseline assessments to start prior to the beginning of any program activities or the academic calendar.

⁴ The list of covariates in the logistic model for the 2013 cohort included age, gender, urban/rural domicile, Progress out of Poverty Index, Senior 5 marks, Senior 6 marks, years of computer use, whether both parents were living, whether the student had a job prior to university, whether the student came from a private secondary school, expected earnings post-graduation, and expected earnings five year post-graduation.

with comparison students on propensity scores, resulting in 47 SNHU-Kepler students⁵ and 100 comparison students in our sample.

2014 cohort

We refined our matching process the following year to identify a matched comparison group for the incoming cohort of SNHU-Kepler students. We added one university to the previous year's list, for a total of five universities where we recruited prospective comparison students. Using contact lists obtained from registrar offices at these universities, we called students and conducted an initial screen of 2,869 prospective comparison students. In addition to filtering out students who did not meet SNHU-Kepler's admission cutoffs for high school grades, national exam scores, poverty status, and age, we asked students whether they had ever heard of SNHU-Kepler. Since SNHU-Kepler had been in operation for a year at this point, and had expanded its advertising and recruiting reach, we wanted to ensure that we were not including students who had heard about but either not applied or had been rejected from SNHU-Kepler. In the end, only 96 or 3.3% of students had ever heard of SNHU-Kepler, and we excluded them from the prospective comparison pool.⁶ 641 students passed this initial screening.

In the next round, we assessed shortlisted students using the same tools that SNHU-Kepler staff had developed for their admissions process, which included an English test, a math test, a one-on-one oral exam to screen for English fluency, and one-on-one interviews. We filtered out students who did not meet that year's benchmarks for admissions, yielding 207 eligible comparison students. In the final round, we administered a battery of baseline assessments to all 111 incoming SNHU-Kepler students and 207 eligible comparison students; these were the same tests used at endline and are described below. To ensure that baseline scores were captured before program effects manifested, we assessed SNHU-Kepler students in June 2014, immediately prior to their summer 'bridge' program. We obtained lists of students in comparison universities in early September 2014, a few weeks before the start of their semester, and so comparison students were filtered and assessed prior to and during the first couple of weeks of the semester.

Before estimating propensity scores, we stratified students by whether they had performed above or below the SNHU-Kepler average for the writing and typing tests. These two tests had the greatest disparity in scores between SNHU-Kepler and unmatched comparison students; in effect by stratifying we were prioritizing balance on these test scores above other criteria in the matching algorithm. We then fit a logistic model for whether each student had enrolled in SNHU-Kepler on survey data and, for this cohort only, baseline scores.⁷

Within each stratum, we intended to match SNHU-Kepler students 1:2 (without replacement) with comparison students on propensity scores. However, only the lowest stratum (students who scored below the average for both the writing and typing tests) had sufficient comparison students to allow for 1:2 matching; in other strata, all of the available comparison students 'matched' with the SNHU-Kepler

⁵ 3 SNHU-Kepler students dropped out soon after the student survey, and so they were dropped from the prospective sample prior to matching.

⁶ Although we did not explicitly ask the 2013 cohort if they had heard about Kepler, the low name recognition in 2014 (and likely lower name recognition in 2013) suggests that the 2013 comparison group likely includes few, if any, students who self-selected out of SNHU-Kepler.

⁷ With the exception of the baseline test scores, the list of covariates in the logistic model for the 2014 cohort was similar to the list for the 2013 cohort and included age, gender, urban/rural domicile, Progress out of Poverty Index, Senior 5 marks, Senior 6 marks, years of computer use, and baseline test scores (IELTS reading; IELTS writing; Watson-Glaser critical thinking; English, math, and logic components of the cognitive skills test; aggregate computer literacy test score; and typing speed).

students. As a result, students in different strata had different probabilities of selection. We correct for this in the analysis by weighting each observation by the inverse likelihood of selection and including strata fixed effects; in the pooled analysis, we include a single ‘stratum’ fixed effect for the 2013 cohort, and all students in that cohort have the same weight. After matching, our final 2014 sample contained 88 SNHU-Kepler students⁸ and 143 matched comparison students.

Table 1 checks for balance on student characteristics after matching SNHU-Kepler students with comparisons students, first for the matched sample at baseline, and second for the remaining sample at endline (we discuss the possible effects of attrition in more detail below). The matched samples are reasonably well-balanced at baseline. There are a few exceptions, though imbalances in these characteristics are likely to affect outcomes in opposite directions: Among remaining students at endline, SNHU-Kepler students are more likely to be poor, whereas comparison students are more likely to be from non-urban areas and are less likely to attend a private high school. Baseline test scores for the 2014 cohort are well-balanced.⁹ These variables are also included as controls in all regression models. Appendix F replicates these balance checks separately for each cohort.

Table 1: Balance checks, pooled cohorts

Variable	Matched sample at <i>baseline</i>			Matched sample at <i>endline</i>		
	SNHU-Kepler	Comparison	p-value of difference	SNHU-Kepler	Comparison	p-value of difference
Age at baseline	19.477 [0.204]	19.422 [0.123]	0.818	19.360 [0.194]	19.644 [0.163]	0.263
Gender (Female = 1, Male = 0)	0.535 [0.044]	0.491 [0.032]	0.414	0.535 [0.049]	0.486 [0.039]	0.436
Urban (Urban = 1, Rural = 0)	0.463 [0.044]	0.424 [0.032]	0.477	0.494 [0.049]	0.364 [0.038]	0.037
Progress Out of Poverty Index: Pr(Below National Poverty Line)	51.347 [1.015]	48.791 [0.762]	0.045	51.669 [1.115]	46.917 [0.942]	0.001
Both Parents Alive (Yes = 1, No = 0)	0.505 [0.044]	0.537 [0.032]	0.556	0.544 [0.049]	0.575 [0.039]	0.622
Exposure to English at Home (Yes = 1, No = 0)	0.180 [0.034]	0.257 [0.028]	0.079	0.192 [0.039]	0.205 [0.032]	0.796
Senior 6 Marks	76.356 [0.496]	74.600 [0.468]	0.010	76.407 [0.540]	75.317 [0.544]	0.156
Private Secondary School (Yes = 1, No = 0)	0.498 [0.044]	0.341 [0.031]	0.004	0.466 [0.049]	0.330 [0.037]	0.028
Years of Computer Use	4.718 [0.212]	4.908 [0.172]	0.488	4.892 [0.226]	4.680 [0.213]	0.495
Household Owns Computer (Yes = 1, No = 0)	0.184 [0.034]	0.194 [0.026]	0.814	0.191 [0.039]	0.144 [0.028]	0.327
Expected Earnings Post-Graduation (RWF)	456,611 [24,362]	406,844 [19,469]	0.111	448,757 [27,834]	385,709 [23,796]	0.086
Expected Earnings 5-years Post Graduation (RWF)	1,405,437 [107,691]	1,558,827 [105,341]	0.309	1,372,735 [121,287]	1,531,581 [127,543]	0.368

⁸ 23 SNHU-Kepler students did not complete the bridge program, and so they were dropped from the prospective sample prior to matching.

⁹ We did not collect pre-program baseline test scores for the 2013 cohort.

Baseline Reading Score, out of 100 points (2014 only)	32.557 [1.518]	31.808 [1.079]	0.687	34.050 [1.974]	31.580 [1.283]	0.295
Baseline Writing Score, out of 100 points (2014 only)	71.495 [1.778]	70.817 [1.144]	0.749	72.110 [2.111]	72.167 [1.360]	0.982
Baseline Critical Thinking, out of 100 points (2014 only)	47.898 [1.271]	48.729 [0.822]	0.583	48.464 [1.543]	49.051 [0.988]	0.749
Baseline English Score, out of 100 points (2014 only)	50.855 [2.410]	50.777 [1.822]	0.979	48.998 [2.694]	50.174 [2.118]	0.732
Baseline Math Score, out of 100 points (2014 only)	40.421 [2.194]	44.699 [1.538]	0.111	40.471 [2.565]	45.149 [1.974]	0.150
Baseline Logic Score, out of 100 points (2014 only)	52.658 [2.035]	50.553 [1.693]	0.427	53.146 [2.483]	52.079 [1.981]	0.737
Baseline Computer Literacy, out of 100 points (2014 only)	25.931 [1.146]	25.299 [0.944]	0.670	26.554 [1.374]	24.790 [1.059]	0.311

Means adjusted for inverse probability weights.

Data collection and Outcomes

In March 2019 (between 5 to 6 years after baseline), we tracked down students from both cohorts and administered skills tests and an employment survey.¹⁰ At that point in time, 90.7% of SNHU-Kepler students and 93.2% of comparison students had graduated with a Bachelor’s degree, while 5.6% and 6.8% respectively were still pursuing their degrees (and 3.7%¹¹ and 0.6% respectively had dropped out). Since the SNHU-Kepler program is 3 years in length, the average student from the 2013 cohort had graduated 2.3 years prior to the 2019 endline survey while the average student from the 2014 cohort had graduated 1.4 years ago. In contrast, the average comparison student from 2013 had graduated 1.5 years prior while the average comparison student from 2014 had graduated 0.5 years ago. In the Results section we report outcomes from graduates’ first jobs out of school – which controls for different program lengths – as well as from graduates’ jobs at the time of the survey – which incorporates early graduation into effect sizes.

We administered different versions of the same skills tests that were administered to the 2014 cohort at baseline. These competencies were selected in collaboration with SNHU-Kepler during the evaluation design, and were identified as the most relevant competencies required of graduates in the Rwandan labor market. They include:

- **Cognitive skills (English, math, and logic):** We created paper-based test based on popular standardized exams (SLE, SAT, ACT).
- **English language (reading and writing):** Abridged International English Language Test (IELTS). Paper-based tests with multiple-choice and fill-in-the-blank questions in response to reading passages. The writing test was an essay response to a general prompt.
- **Critical thinking:** Watson-Glaser II test. Web-based multiple-choice test to measure inference, deduction, interpretation, recognizing assumptions, and evaluating arguments.

¹⁰ We also tested SNHU-Kepler students and matched comparison students at various times during their degree programs. Students from the 2013 cohort were tested in 2014, 2015, and 2016, while students from the 2014 cohort were tested in 2015. For a detailed timeline of data collection, see Appendix E.

¹¹ 2 SNHU-Kepler students had graduated with their Associate’s degree, but had stopped pursuing their Bachelor’s degree at SNHU-Kepler. These two students are included in this percentage.

- **Computer literacy:** We created test which includes typing speed test, web research, website credibility, Microsoft Word, Microsoft Excel, Microsoft PowerPoint, and email.

We present scores in terms of standard deviations from the comparison group mean. For additional details on scoring of skills tests see Appendix H.

We also administered a web-based survey to graduates that asked them to self-report their post-graduation labor market outcomes, including employment status each month since graduation, monthly income, hours employed, sector of employment, job satisfaction, debt, and whether they anticipated receiving a promotion or raise. While most graduates took the employment survey at the same time as the skills tests, some graduates who were unable to travel to the testing center took the web-based employment survey remotely.

The skills tests and the employment survey were administered over four weekends in March 2019 at Integrated Polytechnic Regional Center (IPRC) in Kigali. Graduates were compensated for their time as well as reimbursed transport costs to encourage participation.

Prior to endline data collection, the study was preregistered on the Registry for International Development Impact Evaluations (RIDIE)¹² and received institutional review board (IRB) approval from the Rwanda National Council for Science and Technology (NCST).¹³

Attrition

We successfully collected data from 270 of the original 378 students in the matched sample. We were unable to collect data from the remaining students due to outdated contact information or participant refusal (the main reason given was not enough time to attend testing). Table 2 shows the number and fraction of SNHU-Kepler and comparison students in each cohort who completed the skills tests and the employment survey. While nearly the same fraction of SNHU-Kepler and comparison students completed the skills tests, 13 percentage point more SNHU-Kepler students completed the employment survey than comparison students ($p < 0.01$).

Table 2: Attrition rates by group, cohort, and test type

Group	Cohort	Original Sample	Matched	Completed Tests	Skills	Completed Employment Survey
Total	Both	378		233 (62%)		270 (71%)
	2013	47		31 (66%)		40 (85%)
SNHU-Kepler	2014	88		52 (59%)		68 (77%)
	Both	135		83 (61%)		108 (80%)
	2013	100		60 (60%)		62 (62%)
Comparison	2014	143		91 (63%)		100 (70%)
	Both	243		151 (62%)		162 (67%)

¹² Study ID: RIDIE-STUDY-ID-5c9848936449a;

<https://ridie.3ieimpact.org/index.php?r=search/advancedSearchDetailView&id=787>

¹³ NCST/482/48/2018

Given non-negligible attrition and differential rates of attrition across SNHU-Kepler and comparison students for the employment survey, we were concerned that the remaining SNHU-Kepler and matched comparison students in the sample would not be comparable. We address this concern with three robustness tests.

First, we reran the balance checks from the baseline matched sample on the remaining sample at endline. The results are summarized above in Table 1, and Appendix F replicates these balance checks separately for each cohort. The sample remains well-balanced on most characteristics, with balance improving for some characteristics (e.g. exposure to English at home, Senior 6 marks, private high school) and worsening for other characteristics (e.g. urban/rural domicile, expected earnings post-graduation). Given that the endline sample is, on the whole, no less balanced than the baseline sample, our preferred specification uses all non-attrited graduates and controls for these covariates. We also recalculate the inverse probability weights based on the number of individuals remaining in each baseline stratum (treating the 2013 cohort, which was not stratified on test scores during the matching procedure, as its own single stratum). In other words, in our preferred specification we assume that data within each stratum is missing-at-random (MAR).

Second, we bound all labor market outcome coefficients using the procedure described in Lee (2009) and present the results in Appendix C. Lower bounds for each outcome are estimated by trimming the top of the SNHU-Kepler distribution until the remaining data points represent the same fraction as non-attrited comparison students; upper bounds are estimated by trimming the bottom of the SNHU-Kepler distribution. These bounded estimates express the ranges of possible impact if we assume that attriters come from one end of the distribution or the other (e.g. are the highest or lowest income earners). We compare estimates from our preferred specification with bounded estimates.

Third, we recalculated propensity scores for the non-attrited graduates at endline and matched these graduates 1:1. We present the results in Appendix B that only includes matched pairs at endline. We compare estimates from our preferred specification with estimates from this subsample of re-matched graduates.

Analytical model

For each outcome our preferred specification is the following weighted least squares regression model:

$$Y_i^* = \beta_0^* + \beta_1^* T_i + X_i' \beta^* + \alpha_s' \beta^* + \varepsilon_i^*, \text{ where}$$

- Y_i^* denotes the outcome for individual i
- T_i denotes treatment status of individual i , i.e. whether the individual was a student in the SNHU-Kepler program (1) or a matched comparison student (0)
- X_i' denotes the vector of covariates listed in the balance checks in Table 1. For the 2013 cohort, baseline exam scores were set to 0 and a missing baseline dummy variable (i.e. for whether the student was in the 2013 cohort) was included in the regression.
- α_s' denotes a vector of dummy variables corresponding to strata (where the 2013 cohort is considered a single stratum), which is 1 when individual i is in stratum s , and 0 otherwise
- ε_i^* denotes the individual error term i

- * denotes the sampling weights applied to each individual observation, which is equal to the inverse probability of being ‘treated’ in each stratum, recalculated based on the number of SNHU-Kepler and comparison students remaining in each stratum at endline. In other words, weights are equal to the following:
 - For SNHU-Kepler students: inverse of the fraction of SNHU-Kepler students in stratum s relative to all students in stratum s
 - For comparison students: inverse of the fraction of comparison students in stratum s relative to all students in stratum s

We winsorized income and hours worked at the 95th percentile. In Appendix E we report results using non-winsorized versions of these outcomes; point estimates are consistent (though slightly less precise), and statistical significance is not affected. For outcomes measuring income and hours worked, we coded unemployed graduates as 0.

To account for the number of outcomes that we tested, and limit the chance of falsely rejecting null hypotheses, we control for the false discovery rate per the two-stage linear step-up procedure described in Benjamini, Krieger, and Yekutieli (2006). We conduct this procedure separately for the two ‘families’ of outcomes – test scores and employment outcomes – and report p-values (technically, ‘sharpened q-values’, per Anderson (2008)) that have been adjusted to correct for multiple hypothesis tests.

IV. Results

SNHU-Kepler students perform significantly better on skills tests and in the labor market than their matched peers. Differences on skills tests that manifested during degree programs persist several years post-graduation. SNHU-Kepler students are more likely to be employed immediately after graduation, and their first jobs are higher-paying, have longer hours, and are more likely to be protected by a written contract. Incomes earned by SNHU-Kepler graduates diverge further from incomes of comparison students over time.

Skills tests

SNHU-Kepler graduates performed significantly better than comparison students on the skills tests. In Table 3 we report average treatment effects in terms of raw test scores (all tests were scored out of 100 points), as a percentage of the comparison mean, and in standard deviations normalized to the comparison group, along with p-values corrected for multiple hypothesis tests.

Table 3: Skills tests, average treatment effects

Test	Comparison Mean (Out of 100 points)	Avg Treat Effect (Out of 100 pts)	Avg Treat Effect (% of Comparison Mean)	Avg Treat Effect (SDs)	Corrected p-values ¹⁴
Cognitive Skills: English	32.3	12.5 [2.9]	38.8%	0.643 [0.150]	< 0.001
Cognitive Skills: Math	39.0	6.1 [2.3]	15.8%	0.348 [0.131]	< 0.01
Cognitive Skills: Logic	41.1	11.2 [2.9]	27.2%	0.509 [0.133]	< 0.001
English Language: Reading	34.8	12.5 [1.9]	36.0%	0.784 [0.120]	< 0.001
English Language: Writing	62.8	8.1 [1.4]	12.9%	0.821 [0.140]	< 0.001
Critical Thinking	48.1	1.4 [1.5]	2.9%	0.128 [0.141]	0.364
Computer Literacy	29.8	26.4 [2.1]	88.7%	1.820 [0.142]	< 0.001

All regressions include inverse probability weights and control for strata fixed effects and the covariates listed in Table 1. Heteroskedasticity-robust standard errors are reported in brackets below coefficients. Data comes from 83 SNHU-Kepler graduates and 151 matched comparison graduates, except for the English Language: Writing results, which comes from 81 SNHU-Kepler graduates and 151 matched comparison graduates.

Coefficients are large and statistically significant at the 1% level for all tests except critical thinking. SNHU-Kepler graduates outperformed the matched comparison group the most on computer literacy, scoring nearly twice as many points or 1.8 SD more on the test, followed by the English language tests.

In Appendix B we report results from recalculating propensity scores based on students remaining at endline (using their baseline test scores and demographic characteristics) and re-matching students 1:1.¹⁵ This alternative specification is in theory more robust to differential attrition – assuming that the factors included in propensity scores capture the relevant determinants of attrition - though uses data from fewer individuals and so standard errors are larger. The point estimates from this alternative specification are almost the same as in our preferred specification, and though they are less precise, all coefficients (except Critical Thinking) remain statistically significant at the 5% level according to corrected and uncorrected p-values.

¹⁴ The corrected p-value for Critical Thinking (0.06) is actually *less* than the uncorrected p-value (0.36). This unusual case arises because the Benjamini-Krieger-Yekutieli procedure limits the false discovery rate of the *family of outcomes* to a given level. Because all of the other outcomes have small unadjusted p-values – i.e. the probability of false discovery in any one is extremely low – the procedure is more permissible toward the possibility of falsely rejecting the null for the remaining outcome. In this table and in the following table we follow the most conservative interpretation and report the larger of the two p-values.

¹⁵ Although we also present Lee Bounds for test coefficients in Appendix C, they are not particularly informative in this case: A similar fraction of SNHU-Kepler students and matched comparison students completed the skills tests (61% and 62% respectively), and so the Lee trimming procedure yields upper and lower bounds that are tight and almost identical to point estimates. This is in contrast to the employment outcomes, reported in the next section, which had differential response rates and therefore wider bounds.

Average treatment effects for the 2013 cohort were slightly larger than for the 2014 cohort, though the differences between cohorts are not statistically significant in most cases, and coefficients remain large and significant for the 2014 cohort on all tests except for Critical Thinking and Cognitive Skills: Math (Appendix A). These effects are particularly notable for the 2014 cohort since we can confirm (in the balance checks in Appendix F) that SNHU-Kepler students and the matched comparison group started their programs with similar scores on these assessments. We did not assess the 2013 cohort at baseline, and so we rely on the robustness of the propensity score-based matching algorithm to assume that SNHU-Kepler and comparison students would have started at similar levels.

We also assessed SNHU-Kepler and matched comparison students at various points during their academic program: the 2013 cohort was assessed at the end of their 1st, 2nd, and 3rd years, and the 2014 cohort was assessed at the end of their 1st year. We present these midline test results in Appendix D. Across tests and cohorts, SNHU-Kepler graduates outperformed their peers at the end of the first year of the program. These differences were maintained (though for the most part, not further increased) in the 2nd and 3rd years for the 2013 cohort. Several years after graduation, SNHU-Kepler students continued to outperform their matched peers by approximately the same amount, suggesting that skills accrued as a result of the SNHU-Kepler program persist post-graduation.

Labor market outcomes

SNHU-Kepler graduates also outperformed their matched peers in the labor market. Table 4 reports average treatment effects on labor market outcomes as measured through the online survey. For most outcomes, we asked graduates about their current job as well as their first job after graduation. In contrast to the typical 4-year program for students in the comparison group, students in the SNHU-Kepler program completed their degree in an average of 3 years. As a result, SNHU-Kepler students started on the job market 1 year earlier than their peers. Outcomes from jobs at the time of the survey, or “current jobs”, incorporate this extra year on the job market, whereas outcomes from first jobs do not account for it. We think that the former is more informative about the overall impact of the SNHU-Kepler program since a shorter academic program – and more rapid exposure to the job market – is a key feature of the program, while the latter sheds light on whether the shortened program affects initial labor market outcomes.

Table 4: Labor market outcomes, average treatment effects

Indicator (Unit)	Comparison Mean	Avg Treat Effect [SE]	Avg Treat Effect (% of Comparison Mean)	Corrected p-values
Employment: Current ¹⁶ (%)	66.9	21.4 [5.2]	32.0%	< 0.001
Employment: Immediately ¹⁷ After Graduation (%)	29.7	30.4 [6.5]	102.2%	< 0.001
Monthly Income: Current Job (RWF ¹⁸)	190,995.9	212,308.4 [29,673.8]	111.2%	< 0.001
Monthly Income: First Job After Graduation (RWF)	111,059.2	95,089.8 [19,733.9]	85.6%	< 0.001
Weekly Hours: Current Job (Hours)	28.2	10.8 [2.6]	38.3%	< 0.001
Weekly Hours: First Job After Graduation (Hours)	26.7	12.0 [2.2]	44.8%	< 0.001
Written Contract: Current Job (%)	69.7	19.0 [5.0]	27.3%	< 0.001
Written Contract: First Job After Graduation (%)	56.5	33.0 [5.0]	58.4%	< 0.001
Income from Salaried Work (% of Total Income)	67.8	18.1 [4.7]	26.6%	< 0.001

All regressions include inverse probability weights and control for strata fixed effects and the covariates listed in Table 1. Heteroskedasticity-robust standard errors are reported in brackets below coefficients. Data comes from 108 SNHU-Kepler graduates and 162 matched comparison graduates.

Despite the shorter academic program, SNHU-Kepler students have better labor market outcomes immediately after graduation and at the time of the survey. 60% of SNHU-Kepler graduates were employed immediately after graduating, whereas this was true of 30% of comparison graduates. At the time of the survey, 88% of SNHU-Kepler graduates were employed whereas 67% of comparison graduates were employed. SNHU-Kepler students also secure jobs that pay substantially more: 86% more for first jobs and 111% more for current jobs. The divergence in pay over time may reflect both the different nature of jobs secured by SNHU-Kepler versus comparison students, as well as the head start that SNHU-Kepler students have on their peers in the labor market. SNHU-Kepler students also appear to secure higher-quality, more stable jobs: they are more likely to have a written contract and receive a greater portion of their income in salaried labor (and a smaller portion in “side-hustles” or support from relatives). Furthermore, jobs secured by SNHU-Kepler students were more likely to be full-time: SNHU-Kepler students worked 38.7 hours per week on average in their first job since graduation, whereas comparison students worked 26.7 hours per week on average.

Whereas SNHU-Kepler students in the 2014 cohort were 27 pp more likely to be employed than their matched peers at the time of the survey, there was no difference in employment rates for the 2013 cohort,

¹⁶ “Current job” refers to the job a student held at the time of the survey, March 2019.

¹⁷ “Immediately” is defined as 0 months between when students graduated and started their first job.

¹⁸ At the time of the survey, 1 USD was approximately equal to 900 RWF.

suggesting comparison students may eventually secure jobs at similar rates (Appendix A). However, the difference in hours worked is similar for both cohorts, even though the 2013 cohort had been in the labor force for an extra year, and income effects for the 2013 cohort are slightly larger than for the 2014 cohort. The more persistent effects of the program appear to be more on the intensive margin of job quality – higher-paying full-time jobs backed by a written contract – rather than on the extensive margin of employment.

V. Discussion

While standalone vocational training programs have met with limited success in skills training for youth in low- and middle-income countries, the expansion of tertiary education in Sub-Saharan Africa offers an opportunity for universities to take a more central role in tackling the problem of youth unemployment. The results from this evaluation suggest that one potentially effective and scalable model pairs blended learning to deliver skills-based competencies with support in the transition to the labor market.

SNHU-Kepler graduates performed substantially higher than matched comparison graduates on assessments that measured skills relevant to the local labor market, including computer literacy, English reading and writing, and cognitive skills (English, logic, and math). Differences on skills tests that manifested during degree programs persist several years post-graduation. SNHU-Kepler students are also more likely to be employed immediately after graduation, and their first jobs are higher-paying, have longer hours, and are more likely to be protected by a written contract.

This evidence suggests that a skills-based blended learning model could be an effective policy solution to bridging the skills gap between young graduates and the labor market in low- and middle-income countries. Through tailoring course content based on direct feedback from local employers, the SNHU-Kepler program equipped graduates with skills relevant to labor market needs, which, paired with employment coaching, ultimately resulted in higher levels and quality of employment of SNHU-Kepler graduates. Additional research, ideally experimental, would further strengthen the link between reformed skills-based curricula in tertiary institutions and better labor market outcomes for graduates. Further research is also needed to disaggregate the relative impact of the skills-based curriculum versus career services.

These results point to the need for reforming curricula in public and private universities to match the demands of labor markets. Rather than promoting memorization and rote learning, university programs should seek to understand the skills and competencies that are required by local employers and tailor their curricula to equip students with those skills. There is need for more flexible tertiary institutions where curricula and instruction can adapt to the needs of a changing labor market. Furthermore, tertiary institutions should invest resources in career services to support graduates in the transition to the labor market.

Utilizing a blended-learning model could be a cost-effective way of delivering a skills-based curriculum at scale. The demand for tertiary education continues to rise and with it, an increase in enrollment and a strain on public expenditure for tertiary institutions. Utilizing online content could alleviate the financial strain these institutions face and allow additional resources to be invested in individualized academic coaching and career support for graduates. As the region has increased access to internet connection, the blended-learning model offers a scalable policy approach to expand access to quality, skills-based tertiary instruction.

While the differences between SNHU-Kepler students and comparison students are large, statistically significant, and robust to multiple hypothesis corrections, this study has some limitations. First, students were not randomly assigned to the SNHU-Kepler program or other universities.¹⁹ We attempt to mitigate possible selection effects by matching students on the same criteria used by the SNHU-Kepler admissions office, and for the 2014 cohort, matching students on the basis of baseline scores on skills assessments and excluding students from the comparison pool who were aware of the SNHU-Kepler program (and thus self-selected out of it). Our resulting sample is balanced on most observable characteristics. However, there may remain other relevant characteristics that were not proxied by characteristics included in the matching algorithm that affect the probability of selection into the SNHU-Kepler program.

Second, attrition was non-negligible and, for the employment survey, larger for the comparison group than for the SNHU-Kepler group. While remaining students at endline were balanced on observable characteristics, and results are robust to alternative specifications re-matching students 1:1 at endline and applying bounds on coefficients, it is possible that our point estimates do not generalize to attrited students.

Third, we were unable to disentangle the effects of different components of the program. It is unclear whether one component (i.e. the skills-based curriculum, the blended learning approach, or career coaching and services) was more or less effective than the others. Future research could aim to better identify which parts of the program are working best to better direct policy and resources.

Further research is needed to understand the cost-effectiveness of blended learning models relative to employment outcomes. It is also important to understand how demand-side policies, for example, those focusing on generating jobs for skilled graduates, can complement supply-side interventions such as the SNHU-Kepler program. Additionally, this research was unable to distinguish whether graduates of the program were acquiring jobs that previously were unable to be filled in Kigali, or displacing other young professionals from jobs that already existed. Further research could be useful in understanding this “displacement effect”.²⁰ Further research would also be useful on how blended learning-based programs could collaborate with primary and secondary institutions to better prepare students for tertiary education.

¹⁹ SNHU-Kepler considered randomizing admissions for a portion of the incoming class, but the admissions process did not yield enough qualified students to randomize without decreasing the size or quality of the incoming cohort at the time.

²⁰ A study in France found that a work training program resulted in jobs being transferred from those that did not receive the program to those that did, creating a “displacement effect” (Crépon, Duflo, Gurgand, Rathelot, & Zamora, 2013). However, it is unclear whether this same effect exists in the Rwandan context.

References

- Aebischer, P., Escher, G., & Noukakis, D. (2014) Boosting Higher Education in Africa through Shared Massive Open Online Courses (MOOCs). In G. Carbonnier, M. Carton, & K. King (Eds.), *Education, Learning, Training: Critical Issues for Development* (pp. 195-214). Lieden: Koninklijke Brill NV.
- Arias, O. Evans, D. K., & Santos, I. (2019). *The Skills Balancing Act in Sub-Saharan Africa: Investing in Skills for Productivity, Inclusivity, and Adaptability*. Washington, D.C.: International Bank for Reconstruction and Development / The World Bank.
- Blattman, C. & Ralston, L. (2015). *Generating employment in poor and fragile states: Evidence from labor market and entrepreneurship programs*.
- British Council. (2014). Can higher education solve Africa's job crisis? Understanding employability in Sub-Saharan Africa. Retrieved from https://www.britishcouncil.org/sites/default/files/graduate_employability_in_ssa_final-web.pdf.
- Cho, Y., Kalomba, D., Mobarak, A. M., & Orozco, V. (2013). Gender Differences in the Effects of *Vocational Training: Constraints on Women and Drop-Out Behavior* (Discussion Paper No. 7408). Bonn: Institute for the Study of Labor.
- Crépon, B., Duflo, E., Gurgand, M., Rathelot, R., & Zamora, P. (2013). Labor Market Policies Have Displacement Effects? Evidence from a Clustered Randomized Experiment. *Quarterly Journal of Economics*, 531–580. doi:10.1093/qje/qjt001.
- Fares, J. & Garcia, M. (2008). *Youth in Africa's Labor Market*. Washington, DC: The World Bank.
- Filmer D. & Fox L. (2014). *Youth Employment in Sub-Saharan Africa*. Washington, DC: The World Bank.
- Garret, R. & Lurie, H. (2017). Deconstructing competency-based education: An assessment of institutional activity, goals, and challenges in higher education. *Competency-based Education*.
- International Labour Organization. (2017). *Global Employment Trends for Youth 2017: Paths to a better working future*. Geneva: International Labour Office.
- International Labor Organization (2019, April). Unemployment, youth total. Retrieved from <https://data.worldbank.org/indicator/SL.UEM.1524.ZS>.
- McKenzie, D. (2017). How Effective Are Active Labor Market Policies in Developing Countries? (Policy Research Working Paper 8011). World Bank Group.
- O'Flaherty, J. & Phillips, C. (2015). The use of flipped classrooms in higher education: A scoping review. *Internet and Higher Education* 25. 85-95.
- Schendel, R. (2013). *A Critical Missing Element: Critical Thinking at Rwanda's Public Universities and the Implications for Higher Education Reform* (Doctoral dissertation).

UNESCO Institute for Statistics (2019, March). School enrollment, tertiary (% gross). Retrieved from <https://data.worldbank.org/indicator/SE.TER.ENRR?locations=RW&view=chart>.

World Bank. (2009). *Accelerating Catch-up: Tertiary Education for Growth in Sub-Saharan Africa*. Washington, D.C.: The International Bank for Reconstruction and Development / The World Bank.

World Bank. (2010). *Financing Higher Education in Africa*. Washington, D.C.: The International Bank for Reconstruction and Development / The World Bank.

World Bank. (2017). *The Africa competitiveness report 2017 - Addressing Africa's demographic dividend*. Washington, D.C.: World Bank Group. Retrieved from <http://documents.worldbank.org/curated/en/733321493793700840/The-Africa-competitiveness-report-2017-Addressing-Africa-s-demographic-dividend>.

YouthStart Global. (2015). *Youth Economic Opportunity Ecosystem Analysis: Rwanda Country Report*. UN Capital Development Fund.

Appendix

Appendix A: Results Disaggregated by Cohort

Table 5: Skills tests, average treatment effects, 2013 cohort

Test	Comparison Mean (Out of 100 points)	Avg Treat Effect (Out of 100 pts)	Avg Treat Effect (% of Comparison Mean)	Avg Treat Effect (SDs)	Corrected p-values
Cognitive Skills: English	30.7	14.6 [5.3]	47.5%	0.769 [0.279]	< 0.01
Cognitive Skills: Math	35.2	9.5 [4.1]	27.0%	0.648 [0.279]	< 0.05
Cognitive Skills: Logic	35.8	14.3 [6.1]	40.0%	0.803 [0.344]	< 0.05
English Language: Reading	29.4	15.8 [3.5]	53.8%	1.166 [0.257]	< 0.001
English Language: Writing	61.3	9.6 [2.4]	15.7%	1.034 [0.258]	< 0.001
Critical Thinking	46.8	4.0 [3.0]	8.5%	0.453 [0.345]	0.192
Computer Literacy	26.1	28.6 [3.9]	109.7%	2.268 [0.307]	< 0.001

All regressions include inverse probability weights and control for strata fixed effects and the covariates listed in Table 1. Heteroskedasticity-robust standard errors are reported in brackets below coefficients. Data comes from 31 SNHU-Kepler graduates and 60 matched comparison graduates.

Table 6: Skills tests, average treatment effects, 2014 cohort

Test	Comparison Mean (Out of 100 points)	Avg Treat Effect (Out of 100 pts)	Avg Treat Effect (% of Comparison Mean)	Avg Treat Effect (SDs)	Corrected p-values
Cognitive Skills: English	33.4	10.7 [3.8]	32.0%	0.538 [0.190]	< 0.01
Cognitive Skills: Math	41.4	2.9 [2.8]	7.0%	0.152 [0.148]	0.309
Cognitive Skills: Logic	44.5	10.4 [3.4]	23.3%	0.438 [0.145]	< 0.01
English Language: Reading	38.3	8.9 [2.3]	23.1%	0.536 [0.137]	< 0.001
English Language: Writing	63.8	7.9 [1.6]	12.4%	0.781 [0.162]	< 0.001
Critical Thinking	48.9	0.4 [1.8]	0.8%	0.031 [0.148]	0.835
Computer Literacy	32.3	24.4 [2.6]	75.7%	1.605 [0.174]	< 0.001

All regressions include inverse probability weights and control for strata fixed effects and the covariates listed in Table 1. Heteroskedasticity-robust standard errors are reported in brackets below coefficients. Data comes from 52 SNHU-Kepler graduates and 91 matched comparison graduates, except for the English Language: Writing results, which comes from 50 SNHU-Kepler graduates and 91 matched comparison graduates.

Table 7: Labor market outcomes, average treatment effects, 2013 cohort

Indicator (Unit)	Comparison Mean	Avg Treat Effect [SE]	Avg Treat Effect (% of Comparison Mean)	Corrected p-values
Employment: Current (%)	77.4	1.1 [8.2]	1.4%	0.892
Employment: Immediately After Graduation (%)	26.2	34.9 [10.9]	133.2%	< 0.01
Monthly Income: Current Job (RWF)	225,947.0	217,883.8 [61,476.7]	96.4%	< 0.01
Monthly Income: First Job After Graduation (RWF)	117,553.6	58,673.9 [37,794.7]	49.9%	0.124
Weekly Hours: Current Job (Hours)	31.0	9.7 [4.7]	31.2%	< 0.05
Weekly Hours: First Job After Graduation (Hours)	29.1	11.2 [3.6]	38.5%	< 0.01
Written Contract: Current Job (%)	65.4	26.9 [10.3]	41.2%	< 0.05
Written Contract: First Job After Graduation (%)	58.1	26.0 [9.9]	44.8%	< 0.05
Income from Salaried Work (% of Total Income)	75.3	4.6 [7.4]	6.1%	0.533

All regressions include inverse probability weights and control for strata fixed effects and the covariates listed in Table 1. Heteroskedasticity-robust standard errors are reported in brackets below coefficients. Data comes from 40 SNHU-Kepler graduates and 62 matched comparison graduates.

Table 8: Labor market outcomes, average treatment effects, 2014 cohort

Indicator (Unit)	Comparison Mean	Avg Treat Effect [SE]	Avg Treat Effect (% of Comparison Mean)	Corrected p-values
Employment: Current (%)	60.5	28.6 [6.4]	47.2%	< 0.001
Employment: Immediately After Graduation (%)	32.1	26.4 [8.4]	82.4%	< 0.01
Monthly Income: Current Job (RWF)	169,389.8	201,218.8 [35,992.1]	118.8%	< 0.001
Monthly Income: First Job After Graduation (RWF)	107,044.5	105,631.1 [24,715.1]	98.7%	< 0.001

Weekly Hours: Current Job (Hours)	26.5	12.0 [3.2]	45.3%	< 0.001
Weekly Hours: First Job After Graduation (Hours)	25.2	12.9 [2.9]	51.1%	< 0.001
Written Contract: Current Job (%)	72.8	16.3 [6.0]	22.3%	< 0.01
Written Contract: First Job After Graduation (%)	55.5	36.3 [5.9]	65.5%	< 0.001
Income from Salaried Work (% of Total Income)	63.1	24.2 [5.9]	38.4%	< 0.001

All regressions include inverse probability weights and control for strata fixed effects and the covariates listed in Table 1. Heteroskedasticity-robust standard errors are reported in brackets below coefficients. Data comes from 68 SNHU-Kepler graduates and 100 matched comparison graduates.

Appendix B: Matched Pairs Analysis

Table 9: Skills tests, matched pairs analysis, average treatment effects

Test	Comparison Mean (Out of 100 points)	Avg Treat Effect (Out of 100 pts)	Avg Treat Effect (% of Comparison Mean)	Avg Treat Effect (SDs)	Corrected p-values
Cognitive Skills: English	31.4	11.8 [3.3]	37.6%	0.601 [0.166]	< 0.001
Cognitive Skills: Math	37.2	5.7 [2.6]	15.3%	0.336 [0.151]	< 0.05
Cognitive Skills: Logic	40.4	9.1 [3.5]	22.6%	0.392 [0.148]	< 0.01
English Language: Reading	33.1	14.4 [2.1]	43.7%	0.926 [0.137]	< 0.001
English Language: Writing	61.9	8.9 [1.6]	14.4%	0.916 [0.160]	< 0.001
Critical Thinking	47.8	0.8 [1.7]	1.6%	0.072 [0.161]	0.655
Computer Literacy	30.2	24.8 [2.2]	81.9%	1.623 [0.146]	< 0.001

All regressions control for the covariates listed in Table 1. Heteroskedasticity-robust standard errors are reported in brackets below coefficients. Data comes from 82 SNHU-Kepler graduates and 82 matched comparison graduates, except for the English Language: Writing results, which comes from 80 SNHU-Kepler graduates and 92 matched comparison graduates.

Table 10: Skills tests, matched pairs analysis, average treatment effects, 2013 cohort

Test	Comparison Mean (Out of 100 points)	Avg Treat Effect (Out of 100 pts)	Avg Treat Effect (% of Comparison Mean)	Avg Treat Effect (SDs)	Corrected p-values
Cognitive Skills: English	29.0	13.3 [6.2]	45.7%	0.685 [0.320]	< 0.05
Cognitive Skills: Math	34.6	6.3 [4.4]	18.3%	0.442 [0.305]	0.152
Cognitive Skills: Logic	37.1	7.0 [6.7]	18.9%	0.358 [0.343]	0.300
English Language: Reading	28.3	17.6 [4.1]	62.3%	1.447 [0.338]	< 0.001
English Language: Writing	59.6	10.2 [2.9]	17.2%	1.078 [0.307]	< 0.01
Critical Thinking	47.1	3.6 [3.8]	7.7%	0.409 [0.424]	0.338
Computer Literacy	26.9	24.6 [4.3]	91.5%	1.738 [0.301]	< 0.001

All regressions control for the covariates listed in Table 1. Heteroskedasticity-robust standard errors are reported in brackets below coefficients. Data comes from 31 SNHU-Kepler graduates and 31 matched comparison graduates.

Table 11: Skills tests, matched pairs analysis, average treatment effects, 2014 cohort

Test	Comparison Mean (Out of 100 points)	Avg Treat Effect (Out of 100 pts)	Avg Treat Effect (% of Comparison Mean)	Avg Treat Effect (SDs)	Corrected p-values
Cognitive Skills: English	32.8	10.2 [4.3]	31.1%	0.513 [0.218]	< 0.05
Cognitive Skills: Math	38.9	3.3 [3.4]	8.6%	0.181 [0.184]	0.329
Cognitive Skills: Logic	42.4	10.5 [4.3]	24.9%	0.418 [0.171]	< 0.05
English Language: Reading	36.0	11.7 [2.6]	32.5%	0.696 [0.158]	< 0.001
English Language: Writing	63.3	8.8 [1.9]	14.0%	0.918 [0.198]	< 0.001
Critical Thinking	48.3	-0.4 [2.0]	-0.8%	-0.033 [0.172]	0.847
Computer Literacy	32.3	24.0 [3.0]	74.4%	1.536 [0.190]	< 0.001

All regressions control for the covariates listed in Table 1. Heteroskedasticity-robust standard errors are reported in brackets below coefficients. Data comes from 51 SNHU-Kepler graduates and 51 matched comparison graduates, except for the English Language: Writing results, which comes from 49 SNHU-Kepler graduates and 51 matched comparison graduates.

Table 12: Labor market outcomes, matched pairs analysis, average treatment effects

Indicator (Unit)	Comparison Mean	Avg Treat Effect [SE]	Avg Treat Effect (% of Comparison Mean)	Corrected p-values
Employment: Current (%)	62.9	23.6 [6.0]	37.6%	< 0.001
Employment: Immediately After Graduation (%)	31.2	28.7 [7.0]	92.0%	< 0.001
Monthly Income: Current Job (RWF)	190,607.0	207,122.8 [33,117.6]	108.7%	< 0.001
Monthly Income: First Job After Graduation (RWF)	104,511.7	105,494.1 [20,869.2]	100.9%	< 0.001
Weekly Hours: Current Job (Hours)	26.9	11.2 [3.0]	41.4%	< 0.001
Weekly Hours: First Job After Graduation (Hours)	25.3	12.7 [2.6]	50.2%	< 0.001
Written Contract: Current Job (%)	76.3	13.2 [5.6]	17.4%	< 0.05
Written Contract: First Job After Graduation (%)	58.1	31.7 [5.6]	54.5%	< 0.001
Income from Salaried Work (% of Total Income)	64.0	20.8 [5.5]	32.6%	< 0.001

All regressions control for the covariates listed in Table 1. Heteroskedasticity-robust standard errors are reported in brackets below coefficients. Data comes from 105 SNHU-Kepler graduates and 105 matched comparison graduates.

Table 13: Labor market outcomes, matched pairs analysis, average treatment effects, 2013 cohort

Indicator (Unit)	Comparison Mean	Avg Treat Effect [SE]	Avg Treat Effect (% of Comparison Mean)	Corrected p-values
Employment: Current (%)	70.0	2.5 [9.3]	3.6%	0.788
Employment: Immediately After Graduation (%)	25.6	34.8 [12.8]	135.6%	< 0.05
Monthly Income: Current Job (RWF)	227,145.3	212,864.8 [72,927.9]	93.7%	< 0.05
Monthly Income: First Job After Graduation (RWF)	116,126.6	66,190.0 [40,086.0]	57.0%	0.103

Weekly Hours: Current Job (Hours)	28.2	11.3 [5.4]	40.0%	0.065
Weekly Hours: First Job After Graduation (Hours)	28.0	13.3 [4.4]	47.3%	< 0.05
Written Contract: Current Job (%)	71.9	19.7 [11.7]	27.5%	0.097
Written Contract: First Job After Graduation (%)	60.0	20.6 [10.9]	34.3%	0.082
Income from Salaried Work (% of Total Income)	69.3	8.2 [8.3]	11.8%	0.328

All regressions control the covariates listed in Table 1. Heteroskedasticity-robust standard errors are reported in brackets below coefficients. Data comes from 40 SNHU-Kepler graduates and 40 matched comparison graduates.

Table 14: Labor market outcomes, matched pairs analysis, average treatment effects, 2014 cohort

Indicator (Unit)	Comparison Mean	Avg Treat Effect [SE]	Avg Treat Effect (% of Comparison Mean)	Corrected p-values
Employment: Current (%)	58.5	31.2 [7.5]	53.4%	< 0.001
Employment: Immediately After Graduation (%)	35.1	22.7 [9.0]	64.7%	< 0.05
Monthly Income: Current Job (RWF)	168,121.9	190,171.9 [38,918.1]	113.1%	< 0.001
Monthly Income: First Job After Graduation (RWF)	97,364.2	117,141.6 [25,157.8]	120.3%	< 0.001
Weekly Hours: Current Job (Hours)	26.1	11.7 [3.8]	44.7%	< 0.01
Weekly Hours: First Job After Graduation (Hours)	23.7	13.0 [3.4]	54.8%	< 0.001
Written Contract: Current Job (%)	79.5	11.1 [6.8]	13.9%	0.106
Written Contract: First Job After Graduation (%)	56.9	36.6 [7.0]	64.3%	< 0.001
Income from Salaried Work (% of Total Income)	60.7	27.4 [7.2]	45.2%	< 0.001

All regressions control for the covariates listed in Table 1. Heteroskedasticity-robust standard errors are reported in brackets below coefficients. Data comes from 65 SNHU-Kepler graduates and 65 matched comparison graduates.

Appendix C: Lee Bounds Analysis

Table 15: Skills tests, lee bounds analysis, average treatment effects

Test	Comparison Mean (Out of 100 points)	Lower bounds				Upper bounds			
		Avg Treat Effect (Out of 100 pts)	Avg Treat Effect (% of Comparison Mean)	Avg Treat Effect (SDs)	Corrected p-values	Avg Treat Effect (Out of 100 pts)	Avg Treat Effect (% of Comparison Mean)	Avg Treat Effect (SDs)	Corrected p-values
Cognitive Skills: English	32.3	11.1 [5.2]	34.4%	0.111 [0.052]	< 0.05	11.6 [4.5]	36.0%	0.116 [0.045]	< 0.05
Cognitive Skills: Math	39.0	4.2 [4.1]	10.8%	0.042 [0.041]	0.308	4.7 [4.2]	11.9%	0.047 [0.042]	0.274
Cognitive Skills: Logic	41.1	9.2 [5.0]	22.4%	0.092 [0.050]	0.065	9.7 [5.1]	23.7%	0.097 [0.051]	0.058
English Language: Reading	34.8	13.6 [3.6]	39.1%	0.136 [0.036]	< 0.001	14.0 [3.2]	40.2%	0.140 [0.032]	< 0.001
English Language: Writing	62.8	6.2 [2.0]	9.9%	0.062 [0.020]	< 0.01	7.2 [2.6]	11.5%	0.072 [0.026]	< 0.01
Critical Thinking	48.1	1.7 [2.6]	3.5%	0.017 [0.026]	0.509	2.1 [2.6]	4.5%	0.021 [0.026]	0.414
Computer Literacy	29.8	26.2 [3.2]	88.0%	0.262 [0.032]	< 0.001	26.4 [3.7]	88.5%	0.264 [0.037]	< 0.001

All regressions include inverse probability weights. Heteroskedasticity-robust standard errors are reported in brackets below coefficients. Data comes from 83 SNHU-Kepler graduates and 151 matched comparison graduates, except for the English Language: Writing results, which comes from 81 SNHU-Kepler graduates and 151 matched comparison graduates.

Table 16: Skills tests, lee bounds analysis, average treatment effects, 2013 cohort

Test	Comparison Mean (Out of 100 points)	Lower bounds				Upper bounds			
		Avg Treat Effect (Out of 100 pts)	Avg Treat Effect (% of Comparison Mean)	Avg Treat Effect (SDs)	Corrected p-values	Avg Treat Effect (Out of 100 pts)	Avg Treat Effect (% of Comparison Mean)	Avg Treat Effect (SDs)	Corrected p-values
Cognitive Skills: English	30.7	12.8 [6.3]	41.8%	0.128 [0.063]	< 0.05	18.6 [5.6]	60.8%	0.186 [0.056]	< 0.01
Cognitive Skills: Math	35.2	8.5 [4.3]	24.2%	0.085 [0.043]	< 0.05	14.9 [4.4]	42.2%	0.149 [0.044]	< 0.01
Cognitive Skills: Logic	35.8	10.3 [6.7]	28.6%	0.103 [0.067]	0.126	18.7 [6.8]	52.1%	0.187 [0.068]	< 0.01
English Language: Reading	29.4	20.1 [4.5]	68.5%	0.201 [0.045]	< 0.001	25.1 [4.6]	85.5%	0.251 [0.046]	< 0.001
English Language: Writing	61.3	6.5 [2.5]	10.5%	0.065 [0.025]	< 0.05	9.4 [2.7]	15.4%	0.094 [0.027]	< 0.01
Critical Thinking	46.8	3.4 [3.4]	7.3%	0.034 [0.034]	0.315	7.9 [3.1]	16.8%	0.079 [0.031]	< 0.05
Computer Literacy	26.1	31.8 [4.4]	121.9%	0.318 [0.044]	< 0.001	37.6 [5.4]	144.1%	0.376 [0.054]	< 0.001

All regressions include inverse probability weights. Heteroskedasticity-robust standard errors are reported in brackets below coefficients. Data comes from 31 SNHU-Kepler graduates and 60 matched comparison graduates.

Table 17: Skills tests, lee bounds analysis, average treatment effects, 2014 cohort

Test	Comparison Mean (Out of 100 points)	Lower bounds				Upper bounds			
		Avg Treat Effect (Out of 100 pts)	Avg Treat Effect (% of Comparison Mean)	Avg Treat Effect (SDs)	Corrected p-values	Avg Treat Effect (Out of 100 pts)	Avg Treat Effect (% of Comparison Mean)	Avg Treat Effect (SDs)	Corrected p-values
Cognitive Skills: English	33.4	7.3 [4.5]	21.8%	0.073 [0.045]	0.196	10.6 [4.6]	31.6%	0.106 [0.046]	< 0.05
Cognitive Skills: Math	41.4	-2.3 [5.0]	-5.4%	-0.023 [0.050]	0.650	1.6 [4.5]	4.0%	0.016 [0.045]	0.718
Cognitive Skills: Logic	44.5	4.5 [5.1]	10.0%	0.045 [0.051]	0.382	9.2 [5.8]	20.7%	0.092 [0.058]	0.111
English Language: Reading	38.3	6.6 [4.0]	17.3%	0.066 [0.040]	0.196	9.9 [4.1]	25.9%	0.099 [0.041]	< 0.05
English Language: Writing	63.8	4.6 [2.3]	7.3%	0.046 [0.023]	0.164	8.2 [2.6]	12.9%	0.082 [0.026]	< 0.01
Critical Thinking	48.9	-2.8 [2.9]	-5.7%	-0.028 [0.029]	0.346	1.1 [2.7]	2.2%	0.011 [0.027]	0.680
Computer Literacy	32.3	20.4 [3.6]	63.2%	0.204 [0.036]	< 0.001	23.4 [4.1]	72.5%	0.234 [0.041]	< 0.001

All regressions include inverse probability weights. Heteroskedasticity-robust standard errors are reported in brackets below coefficients. Data comes from 52 SNHU-Kepler graduates and 91 matched comparison graduates, except for the English Language: Writing results, which comes from 50 SNHU-Kepler graduates and 91 matched comparison graduates.

Table 18: Labor market outcomes, lee bounds analysis, average treatment effects

Test	Comparison Mean	Lower bounds			Upper bounds		
		Avg Treat Effect [SE]	Avg Treat Effect (% of Comparison Mean)	Corrected p-values	Avg Treat Effect (Out of 100 pts)	Avg Treat Effect (% of Comparison Mean)	Corrected p-values
Employment: Current (%)	66.9	19.4 [5.3]	29.0%	< 0.001	32.8 [4.2]	49.1%	< 0.001
Employment: Immediately After Graduation (%)	29.7	27.9 [5.0]	94.0%	< 0.001	33.4 [5.0]	112.4%	< 0.001
Monthly Income: Current Job (RWF)	190,995.9	135,613.6 [34,869.6]	71.0%	< 0.001	281,081.8 [34,270.6]	147.2%	< 0.001
Monthly Income: First Job After Graduation (RWF)	111,059.2	42,149.0 [25,153.9]	38.0%	0.095	130,753.8 [22,802.8]	117.7%	< 0.001
Weekly Hours: Current Job (Hours)	28.2	7.5 [2.7]	26.7%	< 0.01	17.3 [2.7]	61.3%	< 0.001
Weekly Hours: First Job After Graduation (Hours)	26.7	9.6 [2.4]	36.0%	< 0.001	17.5 [2.2]	65.5%	< 0.001
Written Contract: Current Job (%)	69.7	14.6 [6.2]	21.0%	< 0.05	29.9 [4.7]	43.0%	< 0.001
Written Contract: First Job After Graduation (%)	56.5	33.6 [5.2]	59.5%	< 0.001	43.2 [4.4]	76.5%	< 0.001
Income from Salaried Work (% of Total Income)	67.8	17.8 [4.8]	26.3%	< 0.001	29.8 [4.2]	44.0%	< 0.001

All regressions include inverse probability weights. Heteroskedasticity-robust standard errors are reported in brackets below coefficients. Data comes from 108 SNHU-Kepler graduates and 162 matched comparison graduates.

Table 19: Labor market outcomes, lee bounds analysis, average treatment effects, 2013 cohort

Test	Comparison Mean	Lower bounds			Upper bounds		
		Avg Treat Effect [SE]	Avg Treat Effect (% of Comparison Mean)	Corrected p-values	Avg Treat Effect (Out of 100 pts)	Avg Treat Effect (% of Comparison Mean)	Corrected p-values
Employment: Current (%)	77.4	5.4 [8.7]	7.0%	0.533	22.6 [6.3]	29.2%	< 0.001
Employment: Immediately After Graduation (%)	26.2	40.9 [7.3]	155.8%	< 0.001	41.9 [7.3]	159.6%	< 0.001
Monthly Income: Current Job (RWF)	225,947.0	128,884.7 [51,069.2]	57.0%	< 0.05	357,289.1 [55,340.1]	158.1%	< 0.001
Monthly Income: First Job After Graduation (RWF)	117,553.6	874.7 [37,664.1]	0.7%	0.982	145,522.9 [38,865.0]	123.8%	< 0.001
Weekly Hours: Current Job (Hours)	31.0	6.3 [4.2]	20.3%	0.132	16.7 [3.8]	53.8%	< 0.001
Weekly Hours: First Job After Graduation (Hours)	29.1	8.0 [3.6]	27.4%	< 0.05	16.6 [3.2]	57.0%	< 0.001
Written Contract: Current Job (%)	65.4	22.3 [9.6]	34.2%	< 0.05	34.6 [7.8]	52.9%	< 0.001
Written Contract: First Job After Graduation (%)	58.1	31.6 [8.8]	54.5%	< 0.01	41.9 [7.4]	72.2%	< 0.001
Income from Salaried Work (% of Total Income)	75.3	8.2 [7.5]	10.8%	0.280	24.1 [6.1]	32.0%	< 0.001

All regressions include inverse probability weights. Heteroskedasticity-robust standard errors are reported in brackets below coefficients. Data comes from 40 SNHU-Kepler graduates and 62 matched comparison graduates.

Table 20: Labor market outcomes, lee bounds analysis, average treatment effects, 2014 cohort

Test	Comparison Mean	Lower bounds			Upper bounds		
		Avg Treat Effect [SE]	Avg Treat Effect (% of Comparison Mean)	Corrected p-values	Avg Treat Effect (Out of 100 pts)	Avg Treat Effect (% of Comparison Mean)	Corrected p-values
Employment: Current (%)	60.5	27.3 [6.6]	45.2%	< 0.001	35.7 [10.1]	59.1%	< 0.001
Employment: Immediately After Graduation (%)	32.1	18.9 [6.7]	59.1%	< 0.01	27.5 [6.7]	85.8%	< 0.001
Monthly Income: Current Job (RWF)	169,389.8	141,061.9 [44,837.9]	83.3%	< 0.01	213,561.7 [46,512.6]	126.1%	< 0.001
Monthly Income: First Job After Graduation (RWF)	107,044.5	78,271.1 [35,294.2]	73.1%	< 0.05	120,450.8 [28,942.1]	112.5%	< 0.001
Weekly Hours: Current Job (Hours)	26.5	8.5 [3.6]	32.1%	< 0.05	13.9 [4.2]	52.3%	< 0.001
Weekly Hours: First Job After Graduation (Hours)	25.2	10.8 [3.3]	43.0%	< 0.01	14.8 [3.8]	58.9%	< 0.001
Written Contract: Current Job (%)	72.8	9.5 [8.1]	13.1%	0.240	26.8 [5.9]	36.8%	< 0.001
Written Contract: First Job After Graduation (%)	55.5	34.7 [6.5]	62.5%	< 0.001	43.1 [10.2]	77.6%	< 0.001
Income from Salaried Work (% of Total Income)	63.1	23.3 [6.1]	36.9%	< 0.001	31.5 [7.0]	49.9%	< 0.001

All regressions include inverse probability weights. Heteroskedasticity-robust standard errors are reported in brackets below coefficients. Data comes from 68 SNHU-Kepler graduates and 100 matched comparison graduates.

Appendix D: Skills Results Over Time

The below tables show the average skills scores of SNHU-Kepler graduates and comparison graduates over time. They also report the average treatment effects (ATE) for each evaluation year. The ATEs differ slightly from differences in raw scores due to the inclusion inverse probability weights and control for strata fixed effects and the covariates listed in Table 1.

Table 21: 2013 Cohort Skills Test Scores Over Time

Outcome	2014			2015			2016			2019		
	Mean [SD]		ATE	Mean [SD]		ATE	Mean [SD]		ATE	Mean [SD]		ATE
	SNHU- Kep. N=48	Comp. N=99		SNHU- Kep. N = 47	Comp. N = 95		SNHU- Kep. N = 41	Comp. N = 88		SNHU- Kep. N=31	Comp. N=60	
Cognitive Skills: English ²¹	57.4% [14.8]	47.1% [18.0]	9.8*	45.7% [16.5]	31.0% [17.7]	16.4***	50.2% [19.9]	39.8% [19.0]	7.5	46.8% [20.6]	30.7% [18.9]	14.6**
Cognitive Skills: Math	<i>Not measured</i>			45.8% [18.5]	34.1% [15.0]	10.7***	58.5% [21.1]	41.2% [18.8]	10.0**	47.0% [18.8]	35.2% [14.7]	9.5*
Cognitive Skills: Logic	<i>Not measured</i>			40.4% [16.9]	29.9% [17.3]	10.7***	43.0% [16.7]	30.9% [14.4]	14.1***	50.5% [26.7]	35.8% [17.9]	14.3*
English Language: Reading	73.8% [16.6]	51.7% [21.8]	20.0***	37.0% [13.7]	25.0% [11.6]	10.5***	43.8% [13.7]	28.7% [10.4]	13.0***	52.1% [16.1]	29.4% [13.6]	15.8***
English Language: Writing	<i>Not measured</i>			60.4% [3.5]	56.8% [5.0]	4.2***	65.1% [7.0]	57.3% [7.8]	7.7***	69.1% [8.8]	61.3% [9.3]	9.6***
Critical Thinking	69.7% [12.4]	68.3% [10.8]	-0.1	54.1% [9.4]	47.5% [8.6]	5.4***	54.8% [12.2]	48.0% [8.5]	5.8*	52.6% [12.8]	46.8% [8.8]	4.0
Computer Literacy	45.6% [13.0]	21.7% [9.5]	24.7***	65.6% [8.3]	27.9% [12.9]	35.9***	64.7% [11.5]	28.1% [13.2]	34.9***	60.3% [16.8]	26.1% [12.6]	28.6***

²¹ Administered at 2014 midline, not endline. Results based on 48 SNHU-Kepler students and 49 comparison students.

Table 22: 2014 Cohort Skills Test Scores Over Time

Outcome	2014 (baseline)		2015		ATE	2019		ATE
	Mean [SD]		Mean [SD]			Mean [SD]		
	SNHU- Kep. N = 88	Comp. N = 139	SNHU- Kep. N = 88	Comp. N = 139		SNHU- Kep. N = 52	Comp. N = 91	
Cognitive Skills: English	51.3% [22.3]	50.3% [21.8]	43.2% [19.2]	34.2% [20.0]	9.0***	41.7% [23.8]	33.4% [19.8]	10.7**
Cognitive Skills: Math	40.7% [19.9]	44.5% [18.3]	41.4% [17.9]	40.9% [17.5]	2.5	41.4% [18.9]	41.4% [19.0]	2.9
Cognitive Skills: Logic	52.7% [19.0]	50.6% [20.0]	42.4% [19.1]	34.4% [19.2]	7.9***	51.9% [24.2]	44.5% [23.7]	10.4**
English Language: Reading	33.0% [14.4]	31.6% [12.7]	36.0% [17.0]	29.7% [15.1]	5.8***	46.6% [14.3]	38.2% [16.5]	8.9***
English Language: Writing	72.5% [15.5]	70.2% [13.6]	61.0% [5.2]	58.4% [4.1]	2.5***	70.9% [11.4]	64.0% [10.2]	7.9***
Critical Thinking	48.1% [11.9]	48.5% [9.9]	54.5% [8.2]	49.7% [9.4]	4.9***	48.7% [10.8]	48.9% [11.9]	0.4
Computer Literacy	26.3% [10.8]	25.0% [11.2]	60.0% [11.0]	33.5% [13.9]	26.5***	53.5% [17.1]	32.3% [15.2]	24.4***

Appendix E: Non-winsorized Labor Market Results

Table 23: Labor market outcomes, non-winsorized, average treatment effects

Indicator (Unit)	Comparison Mean	Avg Treat Effect [SE]	Avg Treat Effect (% of Comparison Mean)	Corrected p-values
Monthly Income: Current Job (RWF)	233,067.5	198,386.6 [53,526.6]	85.1%	< 0.001
Monthly Income: First Job After Graduation (RWF)	121,192.4	134,986.3 [35,291.0]	111.4%	< 0.001
Weekly Hours: Current Job (Hours)	29.5	9.9 [2.8]	33.5%	< 0.001
Weekly Hours: First Job After Graduation (Hours)	27.9	11.0 [2.4]	39.4%	< 0.001

All regressions include inverse probability weights and control for strata fixed effects and the covariates listed in Table 1. Heteroskedasticity-robust standard errors are reported in brackets below coefficients. Data comes from 108 SNHU-Kepler graduates and 162 matched comparison graduates.

Table 24: Labor market outcomes, non-winsorized, average treatment effects, 2013 cohort

Indicator (Unit)	Comparison Mean	Avg Treat Effect [SE]	Avg Treat Effect (% of Comparison Mean)	Corrected p-values
Monthly Income: Current Job (RWF)	307,729.2	228,633.8 [128,113.5]	74.3%	0.099
Monthly Income: First Job After Graduation (RWF)	141,948.8	140,821.5 [89,867.1]	99.2%	0.120
Weekly Hours: Current Job (Hours)	32.5	8.3 [5.3]	25.6%	0.119
Weekly Hours: First Job After Graduation (Hours)	30.4	10.7 [3.8]	35.0%	< 0.05

All regressions include inverse probability weights and control for strata fixed effects and the covariates listed in Table 1. Heteroskedasticity-robust standard errors are reported in brackets below coefficients. Data comes from 108 SNHU-Kepler graduates and 162 matched comparison graduates.

Table 25: Labor market outcomes, non-winsorized, average treatment effects, 2014 cohort

Indicator (Unit)	Comparison Mean	Avg Treat Effect [SE]	Avg Treat Effect (% of Comparison Mean)	Corrected p-values
Monthly Income: Current Job (RWF)	186,912.9	195,894.0 [40,803.6]	104.8%	< 0.001
Monthly Income: First Job After Graduation (RWF)	108,361.2	126,480.3 [30,438.7]	116.7%	< 0.001
Weekly Hours: Current Job (Hours)	27.7	11.5 [3.3]	41.4%	< 0.001
Weekly Hours: First Job After Graduation (Hours)	26.3	11.9 [3.1]	45.3%	< 0.001

All regressions include inverse probability weights and control for strata fixed effects and the covariates listed in Table 1. Heteroskedasticity-robust standard errors are reported in brackets below coefficients. Data comes from 108 SNHU-Kepler graduates and 162 matched comparison graduates.

Appendix F: Balance Checks by Cohort

Table 26: Balance checks, 2013 cohort

Variable	Matched sample at <i>baseline</i>			Matched sample at <i>endline</i>		
	Means [Standard Error]			Means [Standard Error]		
	SNHU-Kepler	Comparison	p-value of difference	SNHU-Kepler	Comparison	p-value of difference
Age at baseline	18.739 [0.233]	19.166 [0.172]	0.142	18.735 [0.273]	19.517 [0.229]	0.030
Gender (Female = 1, Male = 0)	0.511 [0.074]	0.450 [0.050]	0.496	0.500 [0.080]	0.419 [0.063]	0.430
Urban (Urban = 1, Rural = 0)	0.553 [0.073]	0.390 [0.049]	0.066	0.575 [0.079]	0.355 [0.061]	0.030
Progress Out of Poverty Index: Pr(Below National Poverty Line)	56.468 [1.719]	49.810 [1.473]	0.004	56.700 [1.857]	46.645 [1.792]	0.000
Both Parents Alive (Yes = 1, No = 0)	0.404 [0.072]	0.470 [0.050]	0.456	0.450 [0.080]	0.500 [0.064]	0.625
Exposure to English at Home (Yes = 1, No = 0)	0.152 [0.052]	0.222 [0.042]	0.296	0.154 [0.057]	0.181 [0.049]	0.718
Senior 6 Marks	78.091 [0.767]	76.322 [0.521]	0.058	77.632 [0.812]	77.145 [0.699]	0.650
Private Secondary School (Yes = 1, No = 0)	0.383 [0.072]	0.300 [0.046]	0.331	0.375 [0.078]	0.274 [0.057]	0.297
Years of Computer Use	4.745 [0.367]	4.810 [0.245]	0.882	4.825 [0.400]	4.677 [0.312]	0.771
Household Owns Computer (Yes = 1, No = 0)	0.149 [0.052]	0.130 [0.034]	0.762	0.150 [0.057]	0.048 [0.027]	0.112
Expected Earnings Post-Graduation (RWF)	536,170 [45,994]	522,000 [37,848]	0.812	527,500 [52,163]	461,290 [47,982]	0.352

Expected Earnings 5-years Post Graduation (RWF)	1,307,447 [72,805]	1,229,500 [61,526]	0.414	1,282,500 [81,385]	1,170,161 [78,292]	0.322
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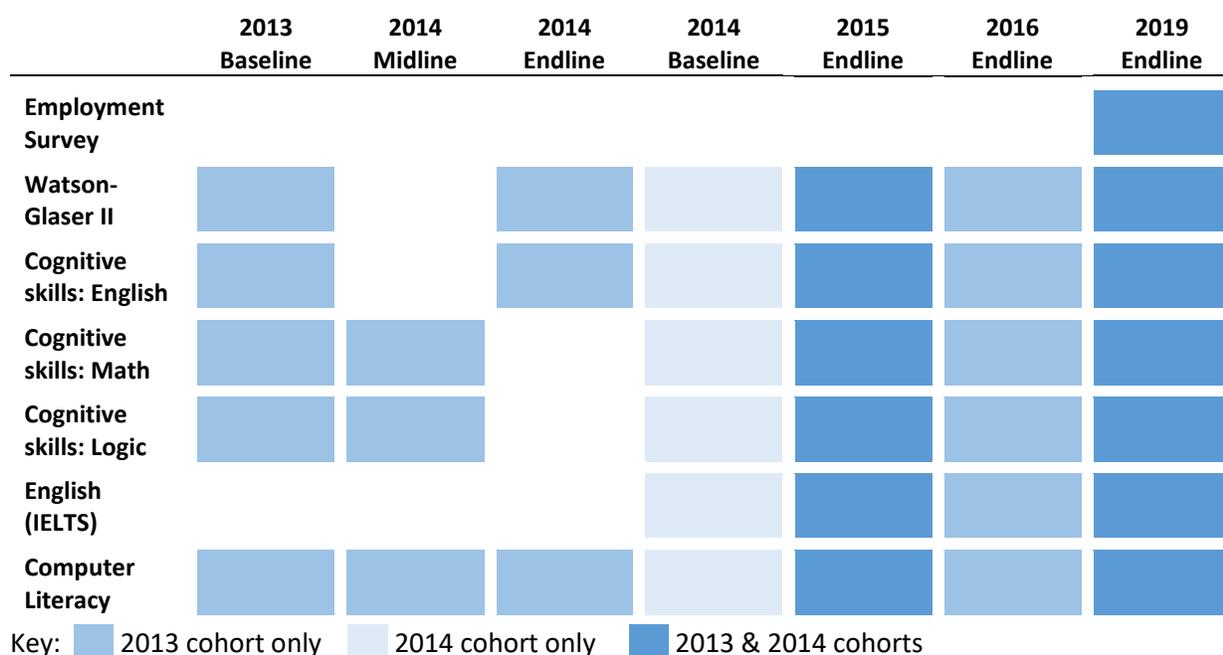
Means adjusted for inverse probability weights

Table 27: Balance checks, 2014 cohort

Variable	Matched sample at <i>baseline</i>			Matched sample at <i>endline</i>		
	Means [Standard Error]			Means [Standard Error]		
	SNHU-Kepler	Comparison	p-value of difference	SNHU-Kepler	Comparison	p-value of difference
Age at baseline	19.952 [0.287]	19.587 [0.168]	0.272	19.746 [0.255]	19.722 [0.223]	0.944
Gender (Female = 1, Male = 0)	0.551 [0.055]	0.517 [0.042]	0.622	0.556 [0.062]	0.527 [0.050]	0.713
Urban (Urban = 1, Rural = 0)	0.404 [0.054]	0.446 [0.042]	0.542	0.444 [0.062]	0.370 [0.049]	0.348
Progress Out of Poverty Index: Pr(Below National Poverty Line)	48.045 [1.097]	48.133 [0.818]	0.948	48.560 [1.250]	47.085 [1.055]	0.368
Both Parents Alive (Yes = 1, No = 0)	0.570 [0.054]	0.580 [0.042]	0.879	0.602 [0.061]	0.621 [0.049]	0.808
Exposure to English at Home (Yes = 1, No = 0)	0.199 [0.044]	0.280 [0.038]	0.159	0.216 [0.052]	0.220 [0.041]	0.951
Senior 6 Marks	75.236 [0.618]	73.489 [0.679]	0.058	75.649 [0.705]	74.187 [0.747]	0.156
Private Secondary School (Yes = 1, No = 0)	0.571 [0.054]	0.368 [0.041]	0.003	0.522 [0.063]	0.364 [0.049]	0.048
Years of Computer Use	4.701 [0.259]	4.971 [0.236]	0.441	4.933 [0.272]	4.681 [0.287]	0.525
Household Owns Computer (Yes = 1, No = 0)	0.206 [0.044]	0.235 [0.036]	0.614	0.217 [0.052]	0.204 [0.041]	0.843
Expected Earnings Post-Graduation (RWF)	405,317 [25,634]	332,599 [18,474]	0.022	400,079 [30,287]	338,986 [23,620]	0.113
Expected Earnings 5-years Post Graduation (RWF)	1,468,615 [170,766]	1,771,157 [166,544]	0.206	1,428,516 [189,940]	1,755,004 [197,542]	0.235
Baseline Reading Score, out of 100 points (2014 only)	32.557 [1.518]	31.808 [1.079]	0.687	34.050 [1.974]	31.580 [1.283]	0.295
Baseline Writing Score, out of 100 points (2014 only)	71.495 [1.778]	70.817 [1.144]	0.749	72.110 [2.111]	72.167 [1.360]	0.982
Baseline Critical Thinking, out of 100 points (2014 only)	47.898 [1.271]	48.729 [0.822]	0.583	48.464 [1.543]	49.051 [0.988]	0.749
Baseline English Score, out of 100 points (2014 only)	50.855 [2.410]	50.777 [1.822]	0.979	48.998 [2.694]	50.174 [2.118]	0.732
Baseline Math Score, out of 100 points (2014 only)	40.421 [2.194]	44.699 [1.538]	0.111	40.471 [2.565]	45.149 [1.974]	0.150
Baseline Logic Score, out of 100 points (2014 only)	52.658 [2.035]	50.553 [1.693]	0.427	53.146 [2.483]	52.079 [1.981]	0.737
Baseline Computer Literacy, out of 100 points (2014 only)	25.931 [1.146]	25.299 [0.944]	0.670	26.554 [1.374]	24.790 [1.059]	0.311

Means adjusted for inverse probability weights

Appendix F: Data Collection Timeline



Appendix G: Data Collection Timeline

Table 28: SNHU-Kepler admissions cutoffs

Variable	Cutoff
Senior 6 Marks	≥ 55.62
Ubudehe	≤ 4
Age	18 – 26
National Exam Scores	ACY: ≥ 42.5 HEG: ≥ 46.75 MCB: ≥ 44.2 MPC: ≥ 44.2 PCM: ≥ 36.55
	CSC: ≥ 36.4 CSM: ≥ 35.7 EIF: ≥ 37.1 MCE: ≥ 25.9 MEG: ≥ 28.0
	MPG: ≥ 30.1 SEC: ≥ 42.5 TOR: ≥ 32.9

See below for National Exam Score acronym definitions:

- ACY: Accounting
- HEG: History, Economics, Geography
- MCB: Math, Chemistry, Biology
- MPC: Math Physics, Biology
- PCM: Physics, Chemistry, Math
- CSC: Computer Science
- CSM: Computer Science, Management
- EIF: Electronic Information
- MCE: Math, Computer Science, Economics

- MEG: Math, Economics, Geography
- MPG: Math Physics, Geography

Appendix H: Scoring of Skills Tests

Cognitive skills: The total correct divided by the total possible points for each section:

- *English:* 10 total points
- *Math:* 14 total points
- *Logic:* 6 total points

English writing: The mean score of four grading criteria, each graded 0-9. The below descriptions describe a 9 in each criteria.

- *Task achievement:* Satisfying all requirements of the task and presenting a fully developed response.
- *Coherence and cohesion:* Using cohesion in a way that attracts no attention and skillfully managing paragraphing.
- *Lexical resource:* Using a wide range of vocabulary with natural and sophisticated control of lexical features.
- *Grammatical range and accuracy:* Using a wide range of structures with full flexibility and accuracy and rare, minor errors.

English reading: The total correct divided by the total possible points (28).

Critical thinking: The total correct divided by the total possible points (28).

Computer Literacy: The mean score of each component, each scored as percentage out of 100:

- *Typing Test:* Speed divided by max score of 61 (max typing speed)
- *Web Research:* Points correct out of 5 total points
- *Web Credibility:* Points correct out of 5 total points
- *Word:* Points correct out of 20 total points
- *Excel:* Points correct out of 20 total points
- *PowerPoint:* Points correct out of 20 total points
- *Email:* Points correct out of 20 total points