



# Research and Policy Brief

## Knewton Adaptive Learning Platform

December 7, 2018

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**Overview:** The online USG collaborative program, eCore, implemented the use of the Knewton Adaptive Learning Platform for MATH 1113 (precalculus) during the 2018 academic year. During this period, the eCore precalculus enrollment was 236 students in Summer 2017, 388 in Fall 2017, and 453 in Spring 2018 (as shown below):

Academic Term	Sections (Course Sec Identifier)	Sections (Section Code)	Enrollment
Summer 2017	72	8	236
Fall 2017	89	11	388
Spring 2018	114	14	453
<b>Grand Total:</b>	<b>275</b>	<b>33</b>	<b>1077</b>

In the Summer 2017 academic term, it is unknown which sections utilized Knewton; in Fall 2017, 113 students were exposed to Knewton and 275 were not. In Spring 2018, Knewton was applied to all eCore precalculus sections. It is important at this point to note the definition of section for eCore differs from the standard interpretation. For non eCore courses, unique sections are determined by a Course Section Identifier. For eCore courses, students enroll at their home institution and have a corresponding Course Section Identifier, but these students are then “placed” into an eCore section with students from other institutions. Those sections are identified by a unique Section Code. Subsequently, in Fall 2017 the 113 students were split across 3 Knewton sections, and 275 students spread across 8 non-Knewton sections.

To the best of our knowledge, the assignment of Knewton across sections was random. As a result, we can compare the outcomes of students that are enrolled in sections that did (treated) and did not (control) use Knewton, to examine the impact of this technology on student success. The outcome of interest is the letter grade earned in MATH 1113.

There are two important features of the comparison:

- We use only Fall 2017 data, since this is the only term where there are some students who were exposed to Knewton and some who were not.
- In Fall 2017, eCore MATH 1113 was offered in both a full and half semester format. Knewton was only used in the full semester sections. Subsequently, we provide two comparisons. We compare students in Full Knewton sections to those in Full Non Knewton sections, as well as compare Full Knewton sections to All Non Knewton sections (this includes the full and half sessions). The first comparison is the most reliable since it eliminates differences in course length across treated and control.

The data for this analysis is based on USG data records.

**Student Characteristics:** Prior to the evaluation of outcomes, an analysis of student characteristics was established. This was done in an effort to assess whether the assignment of Knewton to various sections was indeed random. The more similar the treated and control are in terms of pre-treatment

characteristics (e.g. demographics, prior academic ability) the more likely it is that any differences in MATH 1113 performance are due to Knewton as opposed to other pre-existing factors like academic motivation. Table 1 compares the means for Knewton (**KF** – Full session sections only) and Non-Knewton (**NKF** – Full session sections only, **NK** – Half and Full sessions) sections. The student characteristics used for comparisons are Age at Enrollment, Gender, Race, High School GPA, FT or PT status, Pell Grant receipt, and Student Level.

Table 1 provides the mean values for these characteristics for the KF, NKF, and NK groups, respectively. In addition, the results of difference in means tests are provided for the KF to NKF and KF to NK comparisons.

Looking first at KF relative to NKF we observe that both populations are moderately similar and there are not any statistically significant differences in gender, proportion of under-represented minorities, Pell receipt, high school GPA or Full-Time status. There are however meaningful differences in academic level: A greater proportion of the Knewton students are Dual Enrollment ( $t = 3.4$ ), whereas the non Knewton are more likely to be lower level undergraduates.

Turning to a comparison of Knewton Full Sections to Non Knewton Full and Half Sections (KF to NK) we find the populations are more dissimilar; there are statistically significant differences in high school GPA and Pell receipt as well as in representation of Dual Enrollment versus undergraduates ( $t = 4.58$ ). Larger differences between the KF and NK group, relative to the KF and NKF group, suggest that the latter is the more informative of the two comparisons.

Table 1: Comparison of Means for Students in Knewton Full Sections vs. Non Knewton Full Sections vs. Non Knewton All Sections

	KF	NKF	KF vs NKF		NK	KF vs NK	
			T-Stat	P-value		T-Stat	P-value
Age at Enrollment	21.41	22.22	-1.06	0.29	22.45	-1.52	0.13
Gender <sup>a</sup>	0.68	0.59	1.42	0.16	0.59	1.6	0.11
Race <sup>b</sup>	0.41	0.5	-1.38	0.17	0.49	-1.3	0.19
High School GPA	3.39	3.26	1.6	0.11	3.26	1.68	0.09
FT or PT <sup>c</sup>	0.56	0.6	-0.73	0.46	0.63	-1.28	0.2
Pell <sup>d</sup>	0.28	0.36	-1.46	0.15	0.37	-1.82	0.07
Dual Enrollment	0.29	0.12	3.4	0	0.08	4.58	0
Lower Level	0.52	0.69	-2.85	0	0.71	-3.49	0
Upper Level	0.17	0.17	0.05	0.96	0.19	-0.45	0.65
Post Baccalaureate	0.02	0.02	-0.09	0.93	0.02	-0.02	0.98
A	0.31	0.16	2.85	0	0.15	3.11	0
B	0.21	0.29	-1.48	0.14	0.23	-0.59	0.56
C	0.22	0.16	1.09	0.28	0.17	0.97	0.33
D	0.05	0.1	-1.86	0.06	0.12	-2.6	0.01
F	0.19	0.16	0.56	0.57	0.2	-0.19	0.85
W	0.04	0.13	-2.89	0	0.12	-3.31	0
a. Male=0, Female=1, b. Black or African American, Hispanic or Latino, American Indian or Alaska Native, Native Hawaiian or Other Pacific Islander, and Two or More Races =1, all else=0 c. Part-time=0, Full-time=1, d. Pell Grant=1							
Yellow highlights indicates the difference is statistically significant at the 10% level.							

**Outcomes:** Chart 1 details the grade distribution in Math 1113 between students in the Knewton full session sections (KF) and non-Knewton full session sections (NKF). The chart demonstrates KF students proportionally outperforming the NKF students among those who earned an A: 31% of the Knewton students earned an A compared to 16% of non-Knewton students, and this is statistically significant (see the lower half of Table 1). The non-Knewton students are more likely to have received a D compared to Knewton students, as well as have triple the withdrawal rate.

Chart 2 shows displays the same information but for the KF versus NK (non-Knewton full and half sections). We find similar results as in Chart 1: Knewton students are more likely to receive an A, and less likely to earn a D or withdraw from the course.

Chart 1: Grades in Math 1113

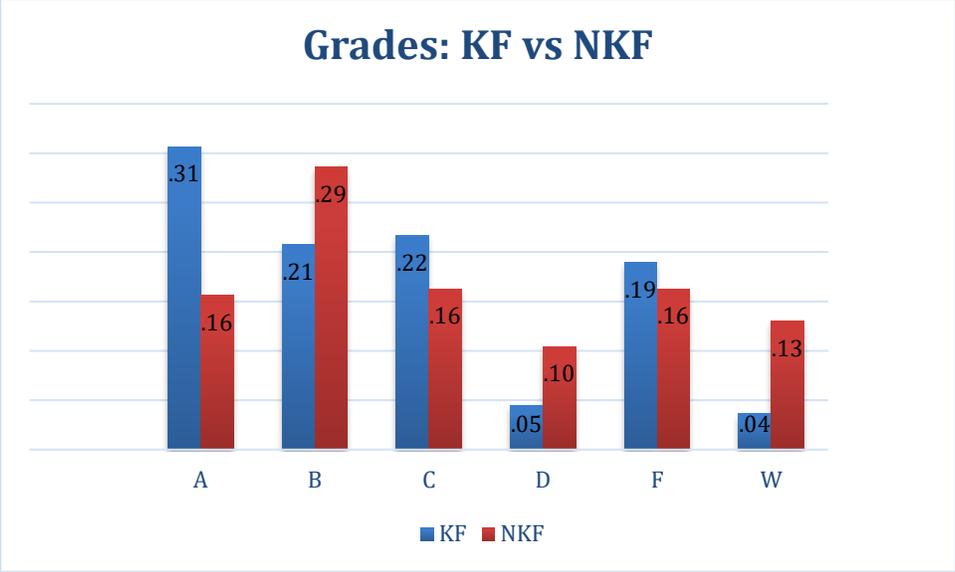


Chart 2: Grades in Math 1113

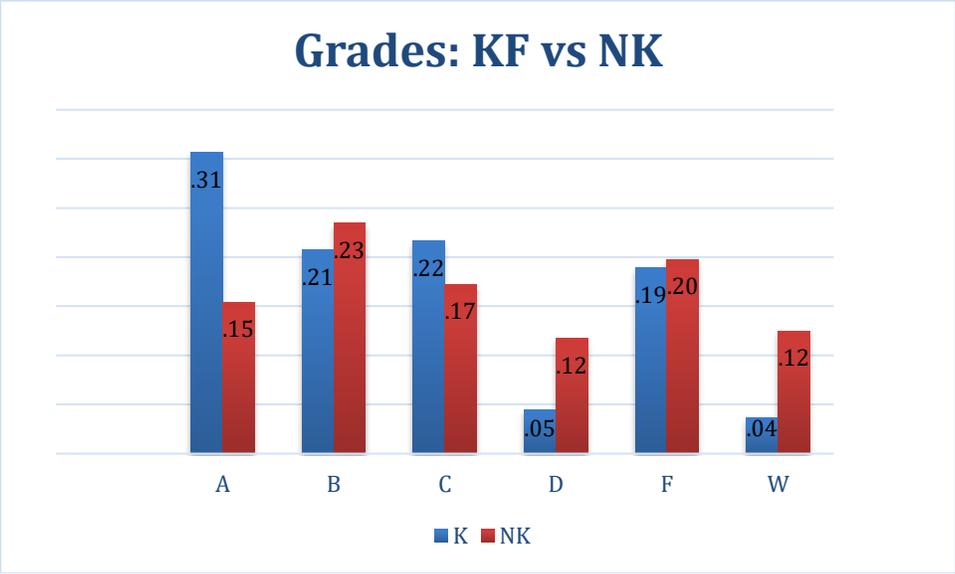


Chart 3: Grade Distribution by Age

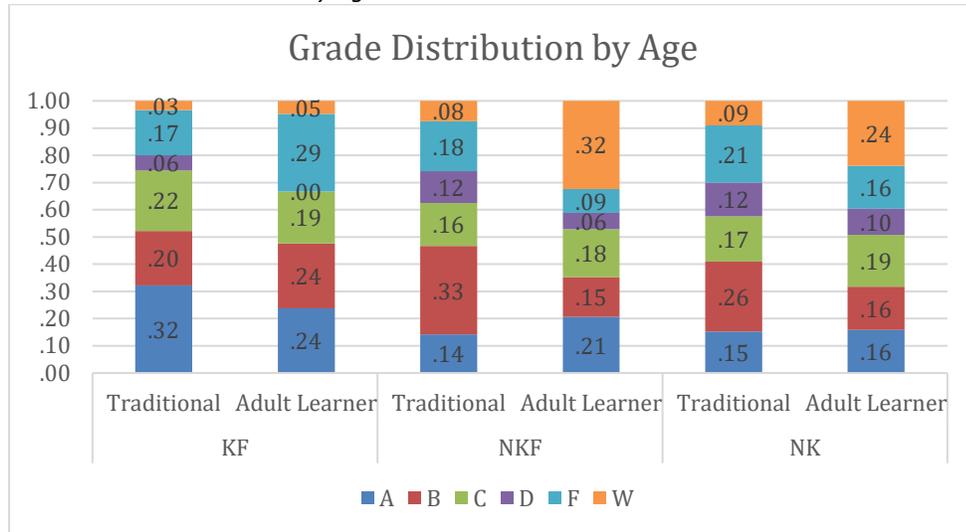


Chart 4: Grade Distribution by Gender

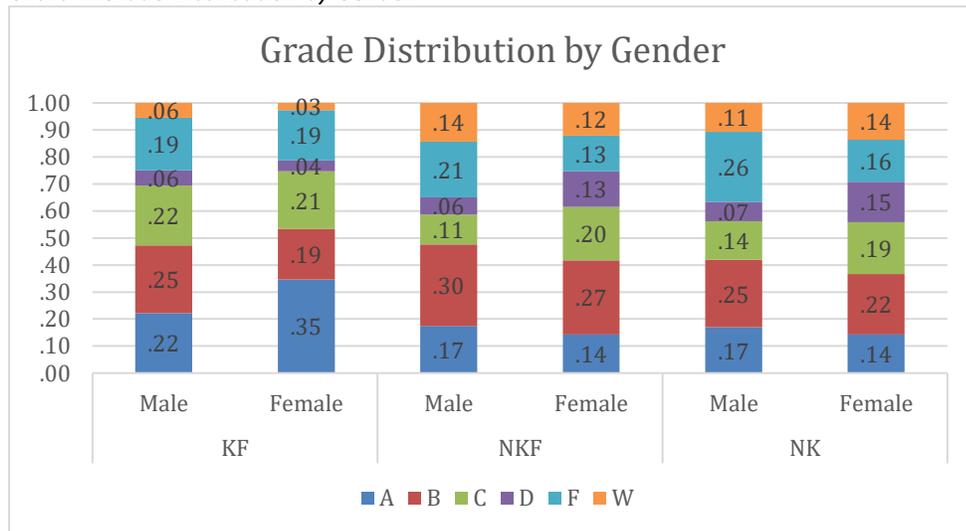


Chart 5: Grade Distribution by Race

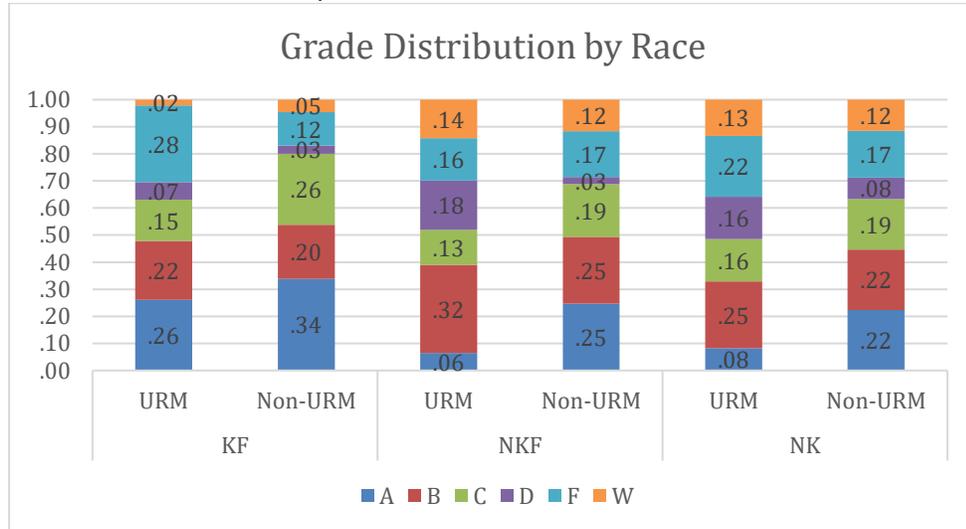


Chart 6: Grade Distribution by Enrollment Status

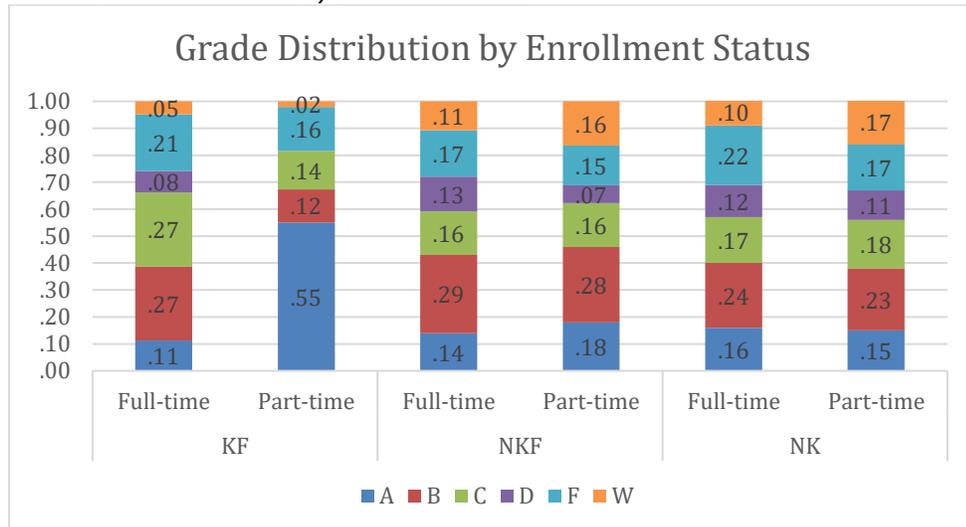


Chart 8: Grade Distribution by Pell

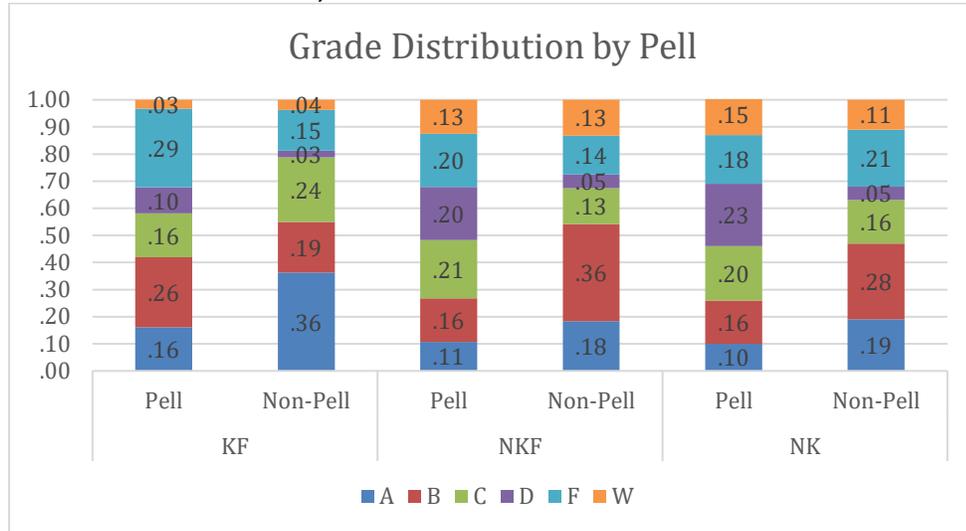


Chart 9: Grade Distribution by Student Level

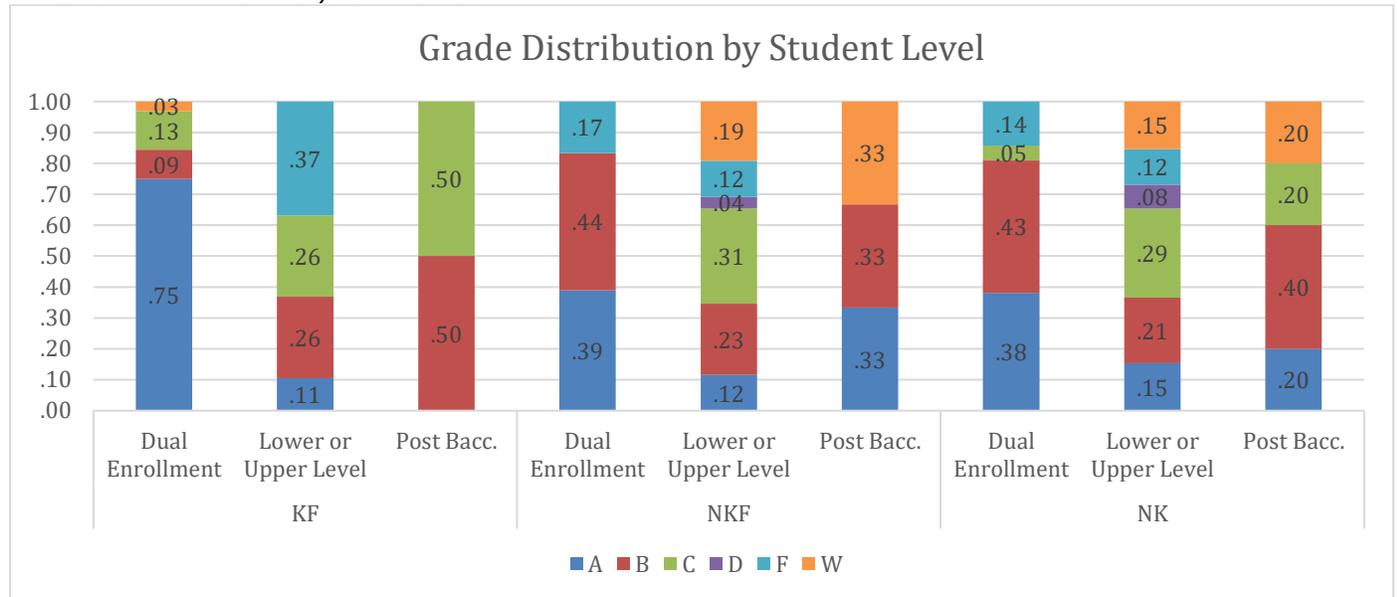
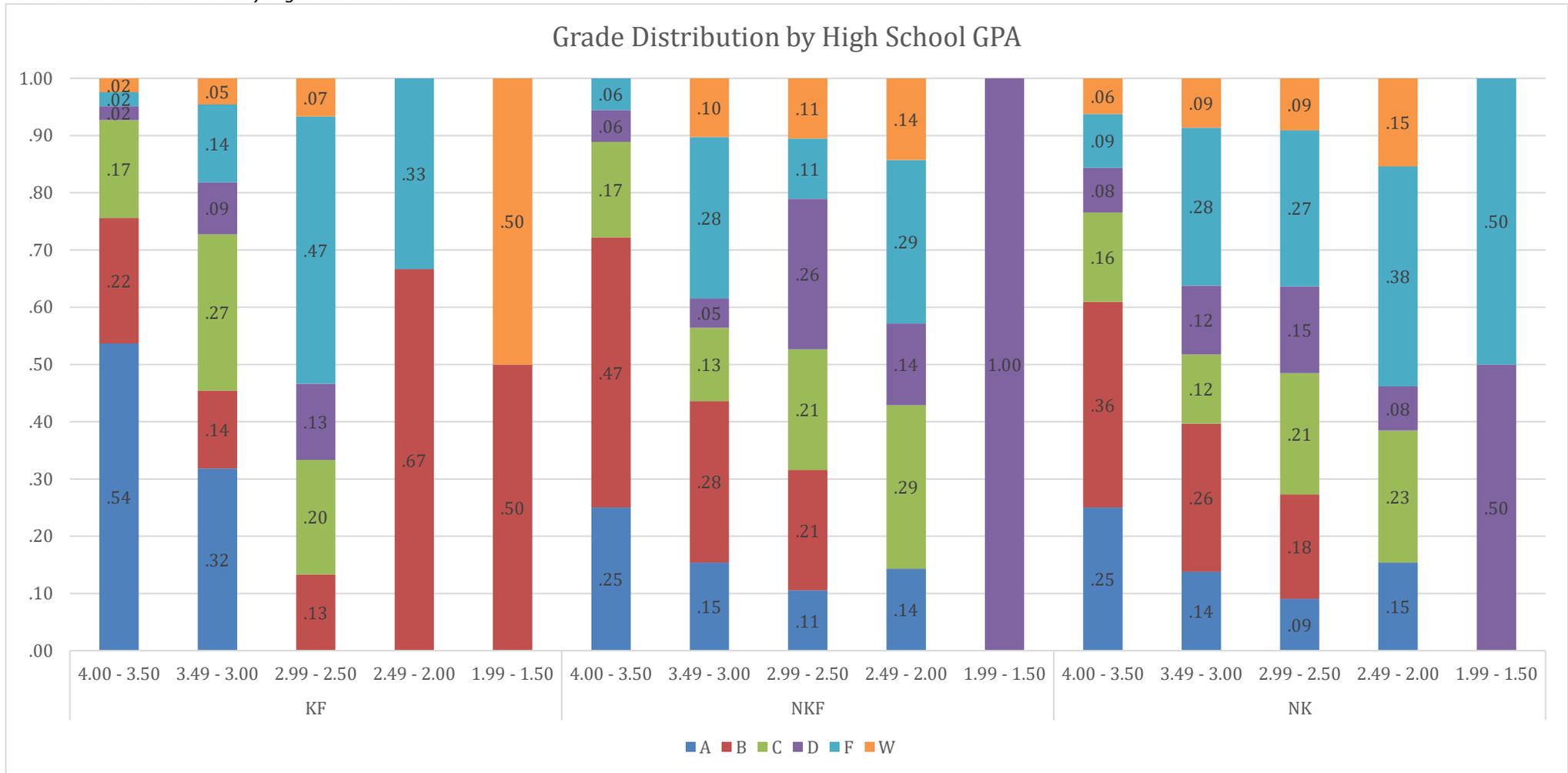


Chart 10: Grade Distribution by High School GPA



Charts 3-10 illustrate the distribution of grades earned across the KF, NK, and NKF sections by the student characteristics listed in Table 1. These breakdowns provide additional insight on the performance of various subgroups within the Knewton and non Knewton sections.

Focusing on the comparison between KF and NKF sections in Chart 3, we observe that a larger proportion of Traditional learners earned an A under Knewton compared to Adult Learners (32% vs 24%). However, this pattern is reversed in the NKF section, where a larger proportion of Adult learners earn As (14% vs 21%)

Regarding the distribution of grades for Gender in Chart 4, both Male and Female learners in the KF sections earn more As when compared to the NKF section learners. A greater proportion of Females learners earned As relative to their male counterparts (35% vs 22%) in the KF section, but this pattern is reversed in the NK and NKF sections.

Concerning grade distribution by Race in Chart 5, both Underrepresented Minority (URM) learners and Non-URM learners earn more As, Bs, and Cs in the KF sections when compared to both the NKF and NK sections. Additionally, URM learners earned more As in the KF (26%) sections when compared to the NKF (6%) and NK (8%) sections. That said, URM learners also earn more Fs in the KF (28%) sections when compared to both the NKF (16%) and NK (22%) sections.

Turning to the grade distribution by Enrollment Status in Chart 6, Part-time learners in the KF sections earn more As (55%) when compared to their Full-time counterparts (11%). Likewise, Part-time learners in the KF sections outperform (As) the other Part-time learners in both the NKF and NK sections. In addition, Full-time learners in the KF sections tend to earn more Cs (27%) than other Full-time learners in the NKF (16%) and NK (17%) sections.

The grade distribution by Pell in Chart 7 demonstrates Pell learners perform better (more As & Bs) in the KF sections when compared to the Pell learners without Knewton, and are less likely to withdrawal from the course. That said, Pell learners are more likely to fail (Fs) the course in the KF (29%) section when compared to both the NKF (20%) and NK (18%) sections. Across all sections, students with Pell earn a lower percentage of As compared to non Pell recipients.

Regarding the grade distribution by Student Level in Chart 9, Dual Enrollment learners earn more As in the KF sections (75%) when compared to other Dual Enrollment learners in the NKF (39%) and NK (38%) sections. In contrast, the Lower and Upper Level learners are more likely to fail (37%) when compared to their peers in sections NKF (12%) and NK (12%). From Chart 1 we know KF sections are more heavily populated by Dual Enrollment learners, and it is likely that the high grades earned by these students are what drive the overall difference in grade outcomes across the K, NKF, and NK sections.

Finally, the grade distribution by High School GPA in Chart 8 demonstrates that the learner's high school performance is strongly correlated with their outcome for the course in both the KF, NKF and NK sections. Comparing students with the same pre-college academic ability (3.5-4 GPA), we observe a higher proportion of the Knewton learners earned As compared to the NKF and NK sections. That same pattern holds for lower GPA bins, however for GPAs between 2.5-2.99, almost half the learners in the KF section earn Fs (47%). Note that because students are grouped by GPA bins, these bins may contain small cell sizes and therefore the chart should be interpreted with this caveat in mind.

**Conclusion:** Is the Knewton Adaptive Learning Platform tied to performance for MATH 1113?

The Fall 2017 outcomes are encouraging: The KF (Knewton Full Session) students' DFW (Grades of D, F, Withdrawal) rate for Fall 2017 were only 27%, while compared to 40% for the NKF (non-Knewton Full Session) students. Likewise, 31% of KF students achieved the letter grade of an A, while only 16% of NKF students achieved an A.

That said, the question remains whether the difference in grade outcomes is due to Knewton or pre-existing differences that exist across the students who were or were not exposed to Knewton. In particular, the examination of student level shows that 29% of the KF population were Dual Enrollment students, compared to 12% in the NKF group. Dual Enrollment students are subject to higher admission standards compared to traditional undergraduates, so this suggests they may be more academically inclined.<sup>1</sup> As a consequence, it is not possible to determine whether the higher grades and lower withdrawal rates among students in Knewton sections is a result of that educational tool or pre-existing differences.

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<sup>1</sup> [https://www.usg.edu/assets/student\\_affairs/documents/USG\\_DE\\_Admission\\_Requirements.pdf](https://www.usg.edu/assets/student_affairs/documents/USG_DE_Admission_Requirements.pdf)