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+lanne# , i""in -ata -e"i n

Doc ment P rpose

The purpo"e o7 thi" #ocument i" to #e"cri9e the metho#" u"e# in 7all 2020 to a#mini"ter the Well9ein A""e""ment% con#ition the #ata% an# "core #imen"ion" 2ith outcome item". 0n7ormation a9out the *ali#ity an# relia9ility o7 the A""e""ment:" 7actor "core" can 9e 7oun# in the Sprin 201; Technical Report.

Ma!or Differences "et#een 20$% and 2020

Althou h 2e mi ht normally 7ocu" only on #i77erence" 9et2een "ur*ey": technical 7eature"% the

2. Social unre"t in reaction to "y"temic raci"m

    a. Althou h #eath" in the U.S. o7 A7rican<American people 'particularly men(#ue to police interaction" ha*e a lon hi"tory o7 9ein #i"proportionately hi her relati*e to the #eath" o7 people 2ho hol# other racial an# ethnic i#entitie"% a "trin o7 the"e *iolent% police< relate# #eath" cau ht pu9lic attention an# "ocial me#ia #urin the late "prin an#

meanin % purpo"e% ci*ic *alue" B moral% an# ci*ic *alue" B political. The mo#elin.26̀6426(W) -3.289(B) - 11.28768139(r

0n#i*i#ual "chool" pro*i#e# participation incenti*e

17 the **6**1 participatin "chool" in the U.S.$

- **G** +u**9**lic/pri*****ate$ 1**8 2**ere pri*****ate% 1**C 2**ere pu**9**lic
- **G** Si**.**e$ 1**?** "chool" ha**#** un**#**er ra**#**uate FT**4** enrollment" o7 **H**10%000@ 1**6** ha**#** enrollment" o7 **I**10%000
- **G** Re ion$
  - o North$ 2 "chool"
  - o South$ 1**C** "chool"
  - o **,** i**#2**e"t$ **?** "chool"
  - o We"t$ **8** "chool"

Data Conditioning

For the *****aria**9**le" u"e**#** to enerate the 7actor "core" in the 15 **#**imen"ion" all participant" recei*****e**#**% unplanne**#** mi""in **#**ata rate" ran e 7rom 0.10**F** to 1**;**.**>**2**F**. 07 you are rea**#**in thi" report in preparation 7or con**#**uctin analy"e" **2**ith **#**ata **2**e ha*****e pro*****i**#**e**#** you% **2**e "tron ly recommen**#** you e*****aluate rate" o7 mi""in **#**ata 7or the *****aria**9**le" in your "tu**#**y.

For the *****aria**9**le" u"e**#** to enerate the 7actor "core"% **2**e te"te**#** 7or **, /** AR u"in **J**ittle:" '1**;??(** **, /** AR te"t u"in the Te"t **, /** ARNormality 7unction in the **,** i"" **,** ech pac**)**a e 'Kam"hi**#**ian et al.% 201**8(** in RStu**#**io **6**.51 'RStu**#**io Team% 201**>(**. **, /** AR **2**a" not re}ecte**#** 'L² M 1**C**2**>C**.**8**2%ɑh7etdsmh " tsmo " Shg**6724**

S)e2ne"" 7or the *aria9le" 2a" mo#e"t on a*era e 'mean M<0.1>% me#ian M<0.6;(. No2e*er% "ome item" #i# #i"play reater ")e2ne"" than i" typically recommen#e#% 2ith a ma5imum *alue o7 1.C> an# a minimum *alue o7 <1.62.

0urto"i" 2ere more *arie#% althou h 2ere mo#e"t on a*era e 'mean M<0.62% me#ian M<0.51(. The *alue" ran e# 7rom <1.6C to 2.00.

0n all our mo#elin % 2e u"e# a ro9u"t ma5imum li)elihoo# e"timator ' , JR(to enerate "tan#ar# error" that 2ere ro9u"t to non<normalitie" in the item #i"tri9ution".

Factor &cores

enerate 7actor "core" that coul# 9e compare# acro"" the year". We #i# t2o "et" o7 mea"urement in*ariance te"t"$ 'a(a "et 2ith 15 #imen"ion" 9oth year" ha# in common@ an# '9(a "et 2ith all 1? #imen"ion" in 2hich Frien#"hip"% /i*ic < , oral% an# /i*ic < +olitical 2ere treate# a" mi""in 7or 7all 2020.

We "tarte# 2ith a 15<#imen"ion mo#el 9ecau"e all item" in the 15 common #imen"ion" 2ere a#mini"tere# acro"" t2o year". The 7ull in7ormation ma5imum li)elihoo# 'F0 , J(e"timator 2a" u"e# to re#uce 9ia" in parameter e"timation" cau"e# 9y mi""in #ata. Then 2e con#ucte# a "erie" o7 mea"urement in*ariance analy"i" 2ith an Da""ume#E 1?<#imen"ion mo#el u"in a multiple imputation metho# to #eal 2ith mi""in ne"" on item" that 2ere not a#mini"tere# in 7all 2020. , ultiple imputation allo2" 7or the uncertainty a9out the mi""in #ata 9y creatin "e*eral #i77erent plau"i9le impute# #ata "et" an# appropriately com9inin re"ult" o9taine# 7rom each o7 them.

15 dimension Measurement Invariance

We con#ucte# the mea"urement in*ariance analy"e" 7or the 15 common #imen"ion" o7 the t2o "ur*ey" a#mini"tere# in 201; an# 2020 2ith the 7ollo2in proce#ure. For the"e mo#el"% 2e u"e# F0 , J to re#uce 9ia" in parameter e"timation" 2ith mi""in ne"" un#er an , /AR 'mi""in completely at ran#om(or an , AR 'mi""in at ran#om(mechani"m.

Follo2in pre*iou" literature '! an#en9er & Jance% 2000(% 2e 7ir"t e"ta9li"he# a 9a"eline mo#el 'con7i ural in*ariance(in 2hich the mo#el "tructure" are the "ame acro"" t2o year" 2hile all parameter" are 7reely e"timate# 7or t2o #i77erent roup". Ne5t% 2e con"traine# the intercept" o7 the mea"urement mo#el 7or each race roup to 9e e=ual an# 7it a metric<in*ariant mo#el throu h an application o7 a con7irmatory analy"i" '/FA(. Finally% 2e con"traine# 9oth intercept" an# loa#in " o7 the mea"urement mo#el to 9e e=ual 7or each roup an# 7it a "calar<in*ariant mo#el. For each "tep% 2e e5amine# 7it in#e5e" inclu#in L2% /F0% TJ0% R , S4A% an# SR , R. /on"i#erin the lar e "ample "i.e an# "en"iti*ity o7 chi< "=uare te"t"% 2e u"e# chan e" in oo#ne"" o7 7it 'P1F("tati"tic" inclu#in /F0 an# R , S4A to #etermine 2hether 2e achie*e# mea"urement in*ariance 7or each "tep. Speci7ically% 2hen the chan e o7 /FA an#

R , S4A i" le"" than 0.01 an# the chan e o7 SR , R i" le"" than 0.025% 2e #etermine the mea"urement in*ariance i" e"ta9li"he# '/hen et al.% 200?@ /heun & Ren"*ol#% 2002(. Ta9le 6 "ummari.e# #etaile# re"ult".

1! dimension measurement invariance "ith multiple imputations

The mice 7unction 'Buuren & Proothui"<1u#"hoorn% 2011(in R"tu#io 2a" u"e# to con#uct multiple imputation" 7or the 3oint #ata"et. Since 2e ha*e complete mi""in ne"" on item" that 2ere not a#mini"tere# in 2020% 2e u"e# a multiple imputation metho# to enerate 7i*e impute# #ata "et"@ computational i""ue" limite# u" to 7i*e #ata copie". We then u"e# a normal e"timation metho# to con#uct mea"urement in*ariance analy"e" a7ter imputation". The c7a.mi 7unction 7rom "emtool" 'Kor en"en et al.% 201;(pac)a e in R 2a" u"e# to te"t the mea"urement in*ariance 7or the 1? latent 2ell9ein #imen"ion" mo#el acro"" t2o year" 2ith 7i*e impute# #ata"et". The re"ult" in#icate# that the metric% loa#in an# "calar mea"urement in*ariance 2a" achie*e# 7or the 1?<#imen"ion mo#el 2ith impute# #ata"et". Speci7ically% the chan e o7 /F0 i" 0.00C an# the chan e o7 R , S4A i" 0.006% 2hich are 9oth "maller than the criteria. Ta9le 8 "ummari.e# #etaile# re"ult".

,*+(aminations of items of the Acti'ity +ngagement dimension

#$T%_1 #$T%_& items

We chan e# the Acti*ity 4n a ement item" in the 2020 7all a#mini"tration" to capture all 7orm" o7 re"pon#ent": acti*ity en a ement 9ecau"e on<campu" en a ement 2a" hi hly re"tricte# #ue to the corona*iru" pan#emic. Ta9le 1 '"ee Appen#i5(#i"play" the "prin 201; 2or#in an# the 7all 2020 2or#in .

A. Te"t" o7 partial mea"urement in*ariance u"in the 15 common #imen"ion" acro"" the "prin 201; an# 7all 2020 "ample" treatin the A/T2A1% A/T2A2 an# A/T2A6 item" a" thou h it 2a" the "ame item in 9oth year".

B. /ompari"on" o7 item an# "core #i"tri9ution" acro"" the "prin 201; an# 7all 2020 "ample" u"in the 15 common #imen"ion".

To con#uct the"e analy"e"% 2e 9e an 2ith the 15<#imen"ion F0 , J mo#el 7rom Step 2. We u"e# thi" approach rather than attemptin multiple imputation 2ith all 1? #imen"ion" 9ecau"e imputin all #ata 7or three #imen"ion" 'Frien#"hip"% /i*ic< , oral% /i*ic<+olitical(in 7all 2020 2oul# 9e unrelia9le. A #ra29ac) to thi" approach i" that 2e 2ere una9le to e5amine the e77ect" o7 the 2or#in chan e" 2ithin the ori inal% 1?<#imen"ion 7rame2or).

#. 'artial measurement invariance testing

+artial mea"urement in*ariance te"tin e*aluate" the impact o7 con"trainin /7reein 3u"t a 7e2 mo#el parameter" o7 a certain type in"tea# o7 all the parameter" o7 that type 'e. .%3u"t a 7e2 o7 the item<7actor loa#in "%3u"t a 7e2 o7 the item intercept"@ /heun & Ren"*ol#%1;;;(. The purpo"e o7 thi")in# o7 te"tin i" to e*aluate the e5tent to 2hich particular item" mi ht 9e contri9utin to the o*erall 7it o7 the mo#el.

Typically% partial mea"urement in*ariance te"tin i" con#ucte# 9y "tartin 2ith the mo"t con"traine# mo#el an# then relea"in parameter e"timate" until accepta9le mo#el 7it i" achie*e#.

pee?T26 item"" mct ""

Fig re $* Response distrib tions for 2020 scores e(tracted #ith 20$% model parameter estimates and parameter estimates recalibrated to the 2020 data*

-* Conc rrent calibration and factor score calc lations

We ne5t e5tracte# 7actor "core" 7or the 7all 2020 #ata u"in an 1?<#imen"ion concurrent cali9ration mo#el 2ith the 3oint #ata"et 'i.e.% "prin 201; an# 7all 2020(. We cho"e thi" metho# to e"timate the 7all 2020 "core" 9ecau"e the analy"e" in "tep 2 7ou73(") - 1.05554(t) - 2.600#2.60295( )8.19173(e) - 91285(a)

not pre"ente#@ the item" 7or Frien#"hip"% ci*ic<moral an# ci*ic<political are "peci7ie# a" mi""in *alue" in the concurrent cali9ration".

When concurrent cali9ration i" u"e#% item parameter" 7or the operational item" in 9oth the ne2 an# the ol# 7orm" are e"timate# "imultaneou"ly in a "in le cali9ration run 'Nan"on% 1;;;(. Becau"e the ne2 an# ol# 7orm" ha*e item" in common% the re"ultin item parameter" 7or all item" in the concurrent cali9ration run are on the "ame "cale.

A7ter 2e ha*e the e"timate# parameter"% 2e calculate# the un"cale# 7actor "core" 7or the 3oint #ata"et 2ith the lavPredict 7unction in the la*aan 'Ro""eel% 2012(pac)a e.

.* / bser'ed score scaling and lin0ing

Althou h 7actor "core e5traction theoretically re"ult" in 7actor "core" that are normally #i"tri9ute# on a latent trait continuum ran in 7rom <6 to Q6 2ith a mean o7 0 an# "tan#ar# #e*iation o7 1% in practice tho"e "core" are on "li htly #i77erent "cale"$ the mean"% "tan#ar# #e*iation"% an# "cale continuum ran e" may 9e "li htly #i77erent 7rom the *alue" li"te# a9o*e% an# tho"e #i77erence" may *ary acro"" the "cale" '-iSte7ano & Ne""% 2005(. To ma)e meanin 7ul compari"on" 9et2een "core" calculate# 2ith the concurrent cali9rate# mo#el an# the "core" enerate# in 201;% 2e con#ucte# the 7ollo2in "calin an# lin)in proce#ure.

Fir"t% 2e con#ucte# a "calin proce#ure to tran"7orm all the "core" 'i.e.% the 3oint #ata"et o7 "prin 201; an# 7all 2020(calculate# u"in the concurrent cali9ration mo#el to a "cale 2ith a mean o7 50 an# a "tan#ar# #e*iation o7 10. 0t "eem" at thi" point that 2e "houl# 9e 7ini"he# 9ecau"e the ori inal "prin 201; "core" al"o 2ere "cale# to ha*e mean" o7 50 an# "tan#ar# #e*iation" o7 10. No2e*er% 2hen 2e a## the "prin 201; an# 7all 2020 #ata"et" to ether% 2e chan e the relati*e po"ition o7 the "prin 201; participant" to the o*erall #i"tri9ution. We can u"e the Nappine"" #imen"ion "core" a" an e5ample. The Nappine"" #imen"ion:" ori inal "prin 201; mean i" 50 2ith a "tan#ar# #e*iation o7 10. From the

concurrent cali9ration mo#el 2ith the 3oint #ata"et% the "prin 201; Nappine"" #imen"ion:" mean an# "tan#ar# #e*iation are 52.C? an# ;.?C. The "prin 201; participant": responses #i# not chan e% 9ut 9ecau"e the overall #i"tri9ution o7 7actor "core" chan e# 2hen 2e com9ine# the "prin 201; an# 7all 2020 #ata% the "prin 201; "core": relati*e mean an# "tan#ar# #e*iation *alue" chan e#.

To et the "core" 9ac) into the "ame "cale a" the ori inal "prin 201; "core" 'i.e.% mean 50% "tan#ar# #e*iation o7 10(% 2e u"e# a linear lin)in an# e=uatin proce#ure 'Oolen et al.% 2018% p61(. The 7ir"t "tep in thi" proce#ure i" to #e*elop a 7ormula that lin)" 'a(the "prin 201; "core" calculate# 7rom the concurrent cali9ration to '9(the ori inal "prin 201; "core". The linear lin)in an# e=uatin proce#ure i" #e7ine# 9y "ettin "tan#ar# #e*iation "core" '.<"core"(on the t2o 7orm" to 9e e=ual. A7ter "ome al e9ra% the re"ultant 7ormula i" a linear re re""ion in 2hich 2e "ol*e 7or y$

0n thi" 7ormula% 'or (i" the con*erte# "core" 2e nee#% an# i" the "core" 7rom the concurrent cali9ration mo#el. U"in the Nappine"" #imen"ion a" an e5ample% i" the "prin 201; Nappine"" "core" a7ter they ha*e 9een con*erte# 7rom the concurrent cali9ration mo#el "corin ' "core"% mean M 52.?C(to the ori inal "prin 201; "cale 'y "core"% mean M 50(. The "lope 'a(7or thi" 7ormula i" ——% an# the intercept '9(i" —— .07 2e "u9"titute tho"e *alue" into our re re""ion

/ontinuin 2ith our Nappine"" #imen"ion e5ample% Nappine"" #imen"ion "core" 7or all 201; participant" calculate# 7rom the concurrent cali9ration mo#el ha*e a mean o7 52.C? ' (an# a "tan#ar# #e*iation o7 ;.?C '

References

Buuren% S. *an% & Proothui"<1u#"hoorn% 0. '2011(. mice$, ulti*ariate 0mputation 9y /haine# 4=uation" in R. !ournal of Statistical Soft " are% #$'1(% 1B>C. http"$//#oi.or /10.1?>6C/3"".*085.i06

/hen% F.% /urran% +. K.% Bollen% 0. A.% 0ir9y% K.% & +a5ton% +. '200?(. An empirical e*aluation o7 the u"e o7

Tables

Table $* Content differences for items in the Acti'ity +ngagement dimension

ACT23$	Sprin 201;	0 am in*ol*e# in at lea"t one acti*ity at my school that 0 en3oy.
	Fall 2020	0 am in*ol*e# in at lea"t one acti*ity that 0 en3oy.
ACT232	Sprin 201;	0 am in*ol*e# in at lea"t one acti*ity at my school that ha" e5pan#e# my ")ill".
	Fall 2020	0 am in*ol*e# in at lea"t one acti*ity that ha" e5pan#e# my ")ill"
ACT23,	Sprin 201;	0 am in*ol*e# in at lea"t one acti*ity at my school that i" meanin 7ul to me.
	Fall 2020	0 am in*ol*e# in at lea"t one acti*ity that i" meanin 7ul to me.

- A"ian M A"ian not Ni"panic
-

Table . Correlations bet#een the scores e(tracted from the model generated #ith the spring 20$% parameters and the model that #as recalibrated to the fall 2020 data

	happine""	an5iety	#epre""ion	loneline""	"ocial an5iety	li7e "ati"7action	"el7< e"teem	optimi"m	per"e*erance	acti*ity en a ement	aca#emic en a ement	9elon in	meanin	purpo"e	copin

Appendi(

2020 7all a#mini"tration Scorin /o#e

UUU+repare #ata

```
                V/1+0NPA1V%V/1+0NPA2V%V/1+0NPA6V%
                VTR0,AWTSV(
#atAconcuA201;H<#atA201;W%*arAli"t201;X
#atAconcuA201;Yyear H<pa"te'V201;V(
#atAconcuA2020H<#atA2020W%*arAli"t2020A15#imenX
#atAconcuA2020YyearH<pa"te'V2020V(
#im'#atAconcuA2020(
UUUchan e #atAconcuA2020 colname" the "ame a" #atAconcuA201;
colname"'#atAconcuA2020( H< c'VNA++RA1V%VNA++RA2V%VNA++RA6V%VNA++RA5V
                %VANXA1V%VANXA2V%VANXA6V%VANXA5V
                %V-4+A1V%V-4+A2V%V-4+A6V%V-4+A>V%V-4+ACV
                %VJ1N4A1V%VJ1N4A2V%VJ1N4A6V%VJ1N4A8V%VJ1N4A5V
                %VS1/ANXA1V%VS1/ANXA2V%VS1/ANXA6V
                %VJ0F4SATA1V%VJ0F4SATA2V%VJ0F4SATA8V
                %VS4JF4STA1V%VS4JF4STA6V%VS4JF4STA8V
                %V1+TA2V%V1+TA6V%V1+TA5V
                %V+4RSA1V%V+4RSA2V%V+4RSA6V
                %VA/T2A1V%VA/T2A2V%VA/T2A6V
                %VA/A4NPA1V%VA/A4NPA2V%VA/A4NPA6V
                %VB4J1NPA1V%VB4J1NPA2V%VB4J1NPA6V
                %V,4AN0NPA1V%V,4AN0NPA2V%V,4AN0NPA6V
                %V+URA1V%V+URA2V%V+URA6V%
                V/1+0NPA1V%V/1+0NPA2V%V/1+0NPA6V%
                VTR0,AWTSV%VyearV(

UUUUA##9ac)10 item" in 7rien#"hip ci*i1 ci*ic2 #imen"ion"9ac)%
          -2.69869866VJA-182.028 -15.48 TdA[()-2.69869866VJA-182.028 -15.48 TdA[()-2.6986986986
```

#atA"coreA3ointH<r9in#'#atA201;Anon ra#Atem%#atA2020Anon ra#Atem(

```
7itAne22ei ht"concuH<c7a'mo#el201;% mi""in M[7iml[%
#ataM#atA"coreA3oint%"amplin .2ei ht"MVTR0, AWTSV%
        e"timatorMV, JRV%"t#.l*MTRU4(
"coreAconcuH<la*+re#ict'7itAne22ei ht"concu%metho#MVBartlettV(

UUUJinear e=uatin to the ori inal "cale# 201; "core"
UUFir"t "calin t2o "core" to a "cale 2ith a mean o7 50 an# a "tan#ar# #e*iation o7 10
"coreAconcuH<a".#ata.7rame'"coreAconcu(
7or 'i in '1$1?(( \
 "core201;W%iXH<"cale'"core201;W%iX%"caleMTRU4(]10Q50
 "coreAconcuW%iXH<"cale'"coreAconcuW%iX%"caleMTRU4(]10Q50
^
UUUA#3u"te# "cale" "o that the "core" calculate# 7rom concurrent cali9ration" coul# 9e compara9le to
the ori inal 201; "core"
"coreAconcuA201;"caleH<"coreAconcuA201;
7or 'i in '1$1?(( \
 "coreAconcuA201;"caleW%iXH<"cale'"coreAconcuA201;W%iX%"caleMTRU4(]10Q50
^
UUput 2020 "core" 'calculate# 7rom concurrent cali9ration to ori inal 201; "core "cale(
"coreAconcuA2020H<"coreAconcuW11;22$22?21%X
"coreAconcuA2020"caleH<"coreAconcuA2020
7or 'i in '1$1?(( \
 7or '3 in '1$10;00((\
  "coreAconcuA2020"caleW3%iXH<'"coreAconcuA2020W3%iX<
mean'"coreAconcuA201;W%iX%na.rmMTRU4((/"#'"coreAconcuA201;W%iX%na.rm M TRU4(]10Q50
 ^
^

UUU/han e "core name" to V55.FSV
colname"'"core2020A201;parameter"A1?#imen"ion(H<
```

9.16485(o)-6.6257(n)]TJA253.806 0 TdA[(c)-1.3.806 06er

#atA2020A"core"H<c9in#'#atA2020%"coreAconcuA2020"caleW%c'1$15(X(
UU"a*e the 7ile 2020 7all "core" calculation"
2rite.c"*'#atA2020A"core"%V20207allA7actor"core"Aori inal#ati"29aA7allA2020Apo2erA9iA#ummyA*2no
7rie#nci*ic1&2Ane2 "calin .c"*V%ro2.name" M FAJS4)