

# COVID-19 and Alternative Postsecondary Learning

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## Abstract

The coronavirus pandemic has induced an increase in remote activity. Prior research shows that a variety of K-12 educational practices, public preferences, policies, and outcomes have changed as a result of the pandemic. This paper extends the literature on the impact of coronavirus on education to solve for the lack of analysis on professional certifications and other unaccredited postsecondary credentials. This paper investigates the results of an original online questionnaire ( $n = 350$ ) to understand the effects of COVID-19 on support for alternative postsecondary learning. Respondents are U.S. citizens over the age of 18. Cross-sectional analysis using ordinary least squares (OLS) and Iteratively Reweighted Least Squares (IRLS) indicates that individual perception of a large negative impact from coronavirus is significantly correlated with higher favorability to alternative credentials. Analysis indicates that important control factors include industry, ethnicity, and state of residence. Age, gender, income, and level of education are insignificant.

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## 1. Introduction

This study is concerned with alternative postsecondary credentials. This category includes professional certifications, coding bootcamps, work portfolios, and other proof of education other than traditional credentials. In this study, traditional credentials mainly refer to the accredited college degree. Remote learning was an alternative approach to education from inception, and it continues to be deeply involved in alternative learning. This study hypothesizes that the impact of coronavirus is positive on favorability to alternative credentials. Results favor the hypothesis, with evidence that exposure to remote learning is a critical mechanism.

There are three theoretical reasons to suppose that a pandemic would make alternative postsecondary credentials more attractive. The first is that the pandemic response has resulted in exposure to remote activity, and exposure effects are often positive on favorability. Second, alternative learning providers face different incentives compared to traditional providers. Differing incentives may provide an adaptive advantage in the face of rapid social change. A recent paper on organizational agility in higher education points to regulatory challenges and deep, centralized, hierarchical organizational structure as notable disadvantages[1].

The third theory is that a pandemic is a time when normal strangeness increases across society. When the normal level of strangeness increases, things that were already finitely strange become relatively less strange. Alternative credentials are strange in some sense by construction, but the relative stigma associated with these credentials might decrease in a time like that of the present pandemic, where all sorts of previously strange behaviors have become a new normal.

While exposure to some stigma generally increases favorability, there are several special cases where it declines instead. Coronavirus-induced exposure could be such a case of negative exposure for a few reasons. Direct exposure to disease is generally harmful, unwanted, and forced. Disease-induced activities are not

strictly involuntary, but they might be perceived unfavorably by association. The mere exposure effect[2] and familiarity bias[3] are generally positive on favorability to some stimulus, but these exposures are often voluntary. Unwanted exposure that involves harm tends to reduce favorability. Backfire, boomerang, and blowback effects are examples of a negative response to exposure [4, 5, 6]. One study relates closely to the COVID-19 pandemic in finding a backfire effect in efforts to market flu vaccine usage [7]. Interestingly, repeated negative exposure can lead to positive favorability, as documented in work on Stockholm syndrome[8].

The exposure effect of coronavirus and related social changes might reflect a combination of the above effects. As a result, the direction of effect is not apparent without empirical study. Individual favorability to alternative credentials is also like to vary for various personal reasons unrelated to the pandemic. This paper uses multiple regression to hold these sources of variation constant.

There are already several papers examining the impact of coronavirus on the education system. These papers focus on education from kindergarten through high school, but they inspire the hypothesis of a similar situation in higher education. One paper in the Journal of School Choice examined the educational experiences of families under COVID-19[9]. The study found that 57 percent of parents found remote learning worked better than they expected.

## 2. Description of Data and Methodology

This paper leverages an original set of online questionnaire responses ( $n = 350$ ). Responses are cross-sectional data obtained in early February of 2021, about one year after a public health emergency due to the coronavirus outbreak was declared in the United States[10]. Respondents are United States citizens at or over the age of eighteen. Qualified respondents participated in the survey through the Amazon Mechanical Turk platform.

This study uses multiple regression of linear and curvilinear factors to gen-

erate results <sup>1</sup>. Each model in this study follows an ordinary linear model or  
60 a robust linear model (RLM) specification. Ordinary linear models compute  
factor coefficients using ordinary least squares (OLS), and robust linear mod-  
els use iteratively reweighted least squares (IRLS). Factor coefficients across  
these models are comparable, but RLM does not generate a useful R-squared  
statistic for model-level comparison. Robust linear models are useful to improve  
65 estimation when outliers exist[11] and 11 outliers exist in the sample.

Appendix A contains the exact wording and response options for each ques-  
tion. Appendix A also contains the wording for a priming message presented at  
the start of the survey. The priming message lays out the definition of alterna-  
tive credentials for the purposes of the study. The message also provides several  
70 concrete examples of alternative credentials, including “a Certified Project Man-  
ager certification, a portfolio of work, a Khan Academy profile, or a Nanodegree  
from Udacity.”

The questionnaire is composed of fourteen questions. Favorability is the  
dependent variable of interest. Coronavirus impact is the independent variable  
75 of interest. There are also ten control factors and two questions on causality.

Eight of the ten control factors are common controls in the literature. These  
eight controls are categorical measures for for age, gender, ethnicity, income,  
level of education, employment status, the industry of occupation, and state of  
residence.

80 The two remaining controls are unique to this study. Expected convention-  
ality is the first unique control. Expected conventionality is the term used to  
describe the response to question three in the appendix. Expected convention-  
ality explains the effect on favorability that is attributable to the future social  
acceptability of alternative credentials. Correcting for social acceptability al-  
85 lows the remaining effects to be interpreted more accurately as an individual

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<sup>1</sup>While the data for this analysis is not public, the analytical code is open-  
source. See [https://github.com/Vandivier/research-dissertation-case-for-alt-ed/  
tree/master/papers/alt-ed-covid-2/data](https://github.com/Vandivier/research-dissertation-case-for-alt-ed/tree/master/papers/alt-ed-covid-2/data)

preference.

The second unique control is support for online education. Online education is the response to question four in the appendix. This control allows an analyst to hold constant the mode of instruction when interpreting favorability to  
90 alternative credentials.

The primary interest of this study is to identify the effect of coronavirus on favorability. If the effect of coronavirus is significant, a description of the origin of that effect improves the value of the results. The two unique controls and the two questions about causality support investigation into exposure to remote  
95 activity as an explanation.

The variables of interest, causality questions, and the two unique controls obtain Likert-type responses. The impact of coronavirus and the causality questions use a 4-point scale. Favorability and the unique controls use a 10-point scale. Continuous treatment of items on the 10-point scale permits curvilinear  
100 analysis, allowing investigation of marginal effects <sup>2</sup>.

### 3. Results

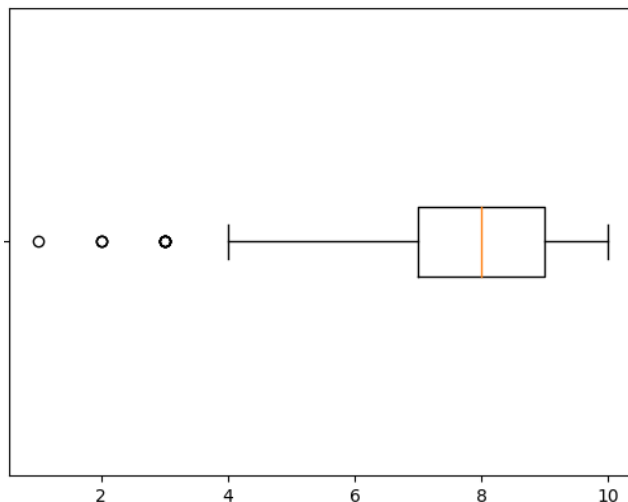
The median favorability response was eight out of ten. Figure 1 visualizes the distribution of responses. Of 350 responses, 11 responses indicate a favorability of less than four out of ten. Regression analysis indicates a significant and  
105 positive coronavirus impact effect. Analysis with and without outliers does not show a meaningful difference in the effect.

The average response was 7.65 on a 10-point scale. Excluding outliers, over 96 percent of responses fall into the normal range. The average response in the

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<sup>2</sup>It is an accepted practice to treat Likert-type responses as either categorical or continuous for regression analysis. Jaccard and Wan provide support for continuous analysis of Likert-type data. They note that severe departures from the assumptions on cardinality “do not seem to affect Type I and Type II errors dramatically,” particularly when the Likert scale is five or more points[12]. This paper treats responses on a 10-point scale as continuous. This paper treats responses on a 4-point scale as categorical.

Figure 1: Distribution of Favorability to Alternative Credentials



normal range was about 7.81. Table 1 summarizes statistics about favorability  
 110 and the direct measure of coronavirus impact. The table also includes summary  
 results for the two causality questions.

Table 1 reports statistics across the total population and also for three sub-  
 populations. The subpopulations include the normal range, the outlier pop-  
 ulation, and the Tens. Because factors in Table 1 dummy variables, with an  
 115 exception for favorability, the mean values for each variable can be interpreted  
 as the proportion of the population that affirms the response.

The Tens are those individuals that responded with a favorability of 10 to  
 alternative credentials. The Tens are not an outlier group, but inspection of  
 this group assists in understanding the response distribution. The Tens report  
 120 a large perceived impact at a disproportionately high rate. In contrast, no  
 member of the negative outlier group also reports a large perceived impact of  
 coronavirus.

This data is consistent with external reporting that COVID-19 impacts most  
 Americans[13], but it adds the wrinkle that most Americans consider the impact  
 125 to be minor. Perceived COVID-19 impact is another case where outliers and  
 Tens importantly differ from the average. The Tens report higher coronavirus

Table 1: Summary Statistics for Factors of Interest

	Total Range	Normal Range	Outliers	Tens
<b>N</b>	350	339	11	58
<b>Favorability</b>	7.65	7.81	2.55	10
<b>Small COVID Impact</b>	0.526	0.534	0.272	0.534
<b>Medium COVID Impact</b>	0.294	0.286	0.545	0.224
<b>Large COVID Impact</b>	0.094	0.097	0	0.138
<b>Small Change to Remote Activity</b>	0.323	0.324	0.273	0.190
<b>Medium Change to Remote Activity</b>	0.274	0.277	0.182	0.190
<b>Large Change to Remote Activity</b>	0.271	0.268	0.364	0.414
<b>Small Increase to Remote Favorability</b>	0.311	0.319	0.091	0.241
<b>Medium Increase to Remote Favorability</b>	0.360	0.360	0.364	0.276
<b>Large Increase to Remote Favorability</b>	0.160	0.156	0.273	0.224

impact while the outliers cluster around a medium impact response.

Table 2 provides factor coefficients for four interesting OLS models. Model 1 is the adjusted R-squared maximizing model. Model 4 is composed only of significant factors. Model 2 is Model 4 plus a dummy for a large coronavirus impact. Model 3 follows the same specification as Model 2, but Model 3 excludes outliers.

The direct effect of coronavirus appears to be positive and also insignificant. The response indicating that a person has perceived a large impact from coronavirus is the only dummy within this categorical variable to appear in any of these models of interest. Notice that the large impact factor is invariant to the outlier subpopulation because no negative outlier reported a large impact.

In a simple regression of the large coronavirus impact dummy on favorability, the variable becomes more significant and important ( $\beta = 0.46, p < 0.15$ ). The two questions on causality<sup>3</sup> partial out the explanation from the direct measure. This is evidence that a coronavirus-induced remote activity exposure accounts for most of the effect attributable to coronavirus.

The two causality questions are significant across models. The coefficients

<sup>3</sup>These include questions thirteen and fourteen in Appendix A.

Table 2: Table of Multiple Regressions with Favorability as Dependent Variable

	Model 1	Model 2	Model 3	Model 4
Favor Online Education <sup>2</sup>	0.11***	0.10***	0.10***	0.10***
Expected Conventionality	0.44***	0.45***	0.38***	0.45***
Large Change to Remote Activity	0.55***	0.51**	0.58***	0.56***
Large COVID Impact	0.32	0.32	0.07	
Small Increase to Remote Favorability	-0.64**	-0.52**	-0.66***	-0.53**
Medium Increase to Remote Favorability	-0.75***	-0.65***	-0.70***	-0.66***
Large Increase to Remote Favorability	-1.00***	-0.85***	-0.71**	-0.80***
Is a Manager	0.32*			
Ethnicity, Caucasian	0.48***	0.43**	0.38**	0.44**
Ethnicity, Hispanic	0.80*	0.77*	0.59	0.76*
Ethnicity, Other	1.51*	1.58**	1.39**	1.52*
Income, 10,000 - 24,999	0.43			
Income, 100,000 - 124,999	0.45			
Income, 125,000 - 149,999	1.15			
Industry, Health	0.56*	0.52*	0.62**	0.55*
Industry, Information Technology	0.35*	0.34*	0.36**	0.34*
Industry, Manufacturing	0.57*	0.66**	0.73***	0.68**
Industry, Real Estate	1.06*	1.13*	0.87	1.14*
State, Florida	-0.38			
State, Georgia	1.21**	1.18**	1.08**	1.22**
State, Idaho	-0.89			
State, Iowa	-2.48***	-2.63***	-0.87	-2.66***
State, Kentucky	-1.28*	-1.22*	-0.33	-1.24*
State, North Carolina	0.73			
State, Ohio	-1.46**	-1.35**	-1.59***	-1.34**
State, Pennsylvania	-1.02**	-1.04**	-0.71	-0.99**
State, Tennessee	-1.75			
Intercept	3.29***	3.48***	4.13***	3.48***
N	350	350	339	350
R-squared	0.39	0.36	0.35	0.35
R-squared Adj.	0.33	0.32	0.31	0.32

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < .01$



range from half a point to a point, which indicates moderate importance. The  
145 first causality question asks whether coronavirus caused an increased degree  
of remote activity for the respondent. The coefficient on the dummy variable  
indicating a large coronavirus-induced increase to remote activity is positive.  
This is consistent with the hypothesis of a positive exposure effect.

The second question on causality asks whether coronavirus-induced remote  
150 activities cause an increase to favorability about remote learning. The exact  
wording is: “To what degree has coronavirus-induced remote activity improved  
your favorability to remote learning (either for yourself or for other people)?”  
Referring back to Table 1, about 83.1 percent of the full population of Ameri-  
cans indicate a small, medium, or large increase in favorability of remote learning  
155 caused by coronavirus-induced remote activity. This study separately demon-  
strates a positive relationship between favorability to remote learning and fa-  
vorability to alternative credentials. Taken together, these two factors provide  
positive evidence toward the hypothesis that coronavirus-induced exposure to  
remote learning results in an increase in favorability to alternative credentials.

160 The observation of nonzero responses to the factor for coronavirus-induced  
remote learning favorability is causal evidence. The fact that these nonzero  
responses are negatively related to favorability is a non-causal association. This  
association indicates that those who gained the most favorability also ended  
with less than average favorability, while those with prior high favorability did  
165 not move much higher. This interpretation is reinforced by referring back to the  
summary statistics in Table 1. Notice that the negative outlier group has the  
highest affirmative response for both a medium increase in remote favorability  
and also to a large increase in remote favorability. On the other hand, the normal  
range has the highest response rate for a small increase to remote favorability.  
170 A relatively small improvement for most respondents makes sense, given that  
the median response is already near the maximum response.

Coronavirus-induced favorability to online education is distinct from a plain  
measure of favorability to online education. The latter is labeled Favor Online  
Education within Table 2, and it is one of the two unique controls discussed in

175 the Methodology. This factor was most significant when modeled as a quadratic  
term. A quadratic term captures marginal effects. The coefficient for this term  
is positive, indicating a positive marginal effect. Favorability to online edu-  
cation and coronavirus-induced favorability to online education are moderately  
correlated (Pearson’s  $r = 0.303$ ). This demonstrates internal consistency among  
180 responses, and it also adds weight to the explanation from exposure.

The other unique control is expected conventionality. This factor is also  
significant, robust to specification, and important. Expected conventionality  
and favorability to online education correlate moderately (Pearson’s  $r = 0.445$ ).  
Expected conventionality is uncorrelated to coronavirus-induced favorability to  
185 online education. Respondents do not form an expectation that alternative  
credentials will be conventional in the future after being exposed to coronavirus-  
induced remote activities.

Table 3 is a table of factors for a robust linear model (RLM). Robust regres-  
sion is useful in addressing samples in which outliers exist, so the robust model  
190 includes the whole sample. Because RLM treats factors linearly, the coefficients  
are comparable to OLS coefficients. This makes the model in Table 3 useful for  
factor analysis as well. Specifically, the model in this table is a simple respecifi-  
cation of Model 4 from Table 2 into RLM. The main result in this table is that  
none of the effects of interest are importantly different between RLM and OLS  
195 specification.

The other control variables also exhibit some interesting effects. Caucasians  
disproportionately attend and graduate from college, leading some scholars to  
argue that higher education is an instrument of white supremacy[14, 15]. Other  
scholars note that alternative learning providers support a higher rate of minor-  
200 ity graduation. As a result, support for alternative credentials is considered a  
workforce diversity strategy[16, 17, 18]. Given such prior research, it is intuitive  
to expect a negative association between caucasian ethnicity and support for  
alternative credentials. Opposite expectation, caucasian ethnic identification  
presents a significant positive coefficient in this study.

205 Information technology is a well-known stronghold of support for alternative

Table 3: Table of Robust Linear Model with Favorability as Dependent Variable

	coef	std err	z	P>  z	[0.025	0.975]
<b>Favor Online Education<sup>2</sup></b>	0.1083	0.033	3.289	0.001	0.044	0.173
<b>Expected Conventionality</b>	0.4566	0.042	10.855	0.000	0.374	0.539
<b>Large Change to Remote Activity</b>	0.6981	0.192	3.637	0.000	0.322	1.074
<b>Small Increase to Remote Favorability</b>	-0.6117	0.236	-2.595	0.009	-1.074	-0.150
<b>Medium Increase to Remote Favorability</b>	-0.7676	0.228	-3.362	0.001	-1.215	-0.320
<b>Large Increase to Remote Favorability</b>	-0.8345	0.290	-2.874	0.004	-1.404	-0.265
<b>Industry, Health</b>	0.5969	0.271	2.205	0.027	0.066	1.128
<b>Industry, Information Technology</b>	0.4016	0.180	2.237	0.025	0.050	0.754
<b>Industry, Manufacturing</b>	0.7399	0.277	2.672	0.008	0.197	1.282
<b>Ethnicity, Caucasian</b>	0.3168	0.161	1.963	0.050	0.001	0.633
<b>Ethnicity, Other</b>	1.7074	0.724	2.359	0.018	0.289	3.126
<b>State, Georgia</b>	1.0604	0.479	2.212	0.027	0.121	2.000
<b>State, Ohio</b>	-1.0150	0.601	-1.690	0.091	-2.192	0.162
<b>State, Pennsylvania</b>	-0.8238	0.441	-1.867	0.062	-1.688	0.041
<b>Intercept</b>	3.5185	0.401	8.785	0.000	2.734	4.303
<b>N</b>	350					

education, including coding bootcamps. Key skills in information technology are easily digitized and taught over the web. This industry demands flexible instruction because it is associated with a uniquely high rate of technical ob-

210 It is surprising that it comes in third place among four industries with positive and significant favorability.

Health is an industry that has historically been difficult to digitize. The positive health industry effect found in this study agrees with external research that considers current digital health education to be satisfactory. One paper on  
215 digital education in health declares that health simulations using virtual reality became useful with the rise of the Oculus Rift after the year 2010[19].

There are various political and cultural reasons for which favorability might vary by state, but the current analysis does not provide strong evidence toward any particular explanation. Employment status was largely insignificant, but  
220 Model 1 hints at a weak positive effect among hiring managers. Other controls are notably insignificant. Gender, age, and level of education had no bearing

on favorability. The insignificance of age and education level provides weak evidence against the hypotheses that older individuals or individuals who do have traditional degrees have a disproportionate opposition to alternative credentials.

#### 225 4. Conclusions

Results indicate that coronavirus as a historical event has significantly improved American favorability to alternative credentials. The effect is not well-explained by the direct impact of coronavirus on an individual. The effect is well-explained as a positive exposure effect that results from coronavirus-  
230 induced remote activities. The largest gains in favorability accrue to individuals that began and ended with less than average favorability.

The introduction provided three explanations for improved favorability, but this study most directly examined an explanation from exposure. If the exposure effect had been weak and favorability improved anyway, the other hypotheses  
235 would have become more important. Given the effectiveness of the exposure-based explanation, the other two explanations are not considered independently important. Arguments from organizational agility and normal strangeness may remain endogenously important. For example, exposure to certain services might improve consumer favorability precisely because organizational agility  
240 has enabled the development of quality products.

As is a cross-sectional analysis, this study provides little ability to make confident forecasts about whether the favorability increase is transient or permanent. With that caveat, there are three reasons to expect average favorability to remain near a score of eight out of ten. The first reason is that this was the  
245 average score found in the analysis. Barring contrary evidence, this point-estimate remains preferred.

The second reason is that there are reasons to expect favorability to increase and to decrease. Without evidence on a significant difference in the magnitudes of effects in either direction, a net expectation of stability results. Mean regression is a reason to expect a favorability decrease. Continuity of trend is a reason  
250

to expect an increase.

The third and strongest reason to expect favorability to remain near the present level is that society has shifted and developed new norms in response to the pandemic. Once society establishes new norms, there are numerous ways  
255 in which those norms reinforce themselves. Status-quo bias and anchoring bias are relevant psychological forces. Economic effects include the endowment effect and ordinary switching costs. For example, an endowment effect might apply to a worker who is now remote and prefers not to return to a physical office.

This study indicates that the population supports alternative credentials.  
260 Policy recommendations that facilitate this preference include improvements to federal recognition and social access. Much of this work is already underway. Many colleges now award credit for professional experience or nontraditional education. Institutions like the American Council on Education (ACE) have facilitated this effort through programs like the current ACE Apprenticeship  
265 Pathways project and the now-defunct Alternative Credit Project (ACP)[20]. Renewal of the ACP is an example of a public-private partnership that is feasible and would improve recognition of alternative credentials.

In 2012, The Heritage Foundation called for certain radical policy changes that would level the playing field between traditional and alternative educators.  
270 While they did not go as far as to suggest eliminating accreditation altogether, they did advocate for removing accreditation agencies. Heritage suggested the government should directly accredit courses rather than organizations[21]. They also called for a decoupling of accreditation and federal funding.

Congress has yet to take Heritage up on the idea, but rule changes from the  
275 Department of Education that took effect in July of 2020 have made accreditation easier[22]. Further accreditation reform can incentivize competition in the university space, essentially causing universities to compete with alternative providers on price and quality to a greater extent. This would not drive support for alternative credentials directly, but improving competition and removing barriers to entry in higher education seems beneficial for the market as  
280 a whole.

Removal of federal subsidies for higher education would reduce college prices and combat student debt, but this is another unpopular reform. A second-best solution would be to open the subsidy to alternative providers. Section 127 of the Internal Revenue Code allows for employer educational assistance. Previously, such assistance consisted of paying for new accredited education. The CARES Act expanded Section 127 employer assistance to include paying down student loans that currently exist from accredited prior education[23]. One small move that would improve access to alternative education would be to modify the definition of educational assistance to include unaccredited learning.

In addition to public policy changes, industry and firm policy changes can facilitate the adoption of alternative credentials. Several high-value corporations have dropped the requirement of a college degree[24]. Other companies allow particular unaccredited credentials to fulfill a college degree requirement. Alternative education providers have also begun providing a payment option using an income sharing agreement (ISA) rather than loans. The income sharing agreement improves access by eliminating the need for student payment until a student obtains employment involving a designated minimum salary.

## References

- [1] S. Menon, M. Suresh, Factors influencing organizational agility in higher education, *Benchmarking: An International Journal* (2020).
- [2] B. M. Robinson, L. J. Elias, Novel stimuli are negative stimuli: Evidence that negative affect is reduced in the mere exposure effect, *Perceptual and Motor Skills* 100 (2) (2005) 365–372.
- [3] H. H. Cao, B. Han, D. Hirshleifer, H. H. Zhang, Fear of the unknown: Familiarity and economic decisions, *Review of finance* 15 (1) (2011) 173–206.
- [4] B. Swire-Thompson, J. DeGutis, D. Lazer, Searching for the backfire effect:

- Measurement and design considerations, *Journal of Applied Research in Memory and Cognition* (2020).
- [5] S. Byrne, P. S. Hart, The boomerang effect a synthesis of findings and a preliminary theoretical framework, *Annals of the International Communication Association* 33 (1) (2009) 3–37.
- [6] R. L. Campagna, A. A. Mislin, D. T. Kong, W. P. Bottom, Strategic consequences of emotional misrepresentation in negotiation: The blowback effect., *Journal of Applied Psychology* 101 (5) (2016) 605.
- [7] B. Nyhan, J. Reifler, Does correcting myths about the flu vaccine work? an experimental evaluation of the effects of corrective information, *Vaccine* 33 (3) (2015) 459–464.
- [8] S. Jülich, Stockholm syndrome and child sexual abuse, *Journal of child sexual abuse* 14 (3) (2005) 107–129.
- [9] D. Carpenter, J. Dunn, We’re all teachers now: Remote learning during covid-19, *Journal of School Choice* 14 (4) (2020) 567–594.
- [10] A. Staff, A timeline of covid-19 developments in 2020 (Jan 2021).  
URL <https://www.ajmc.com/view/a-timeline-of-covid19-developments-in-2020>
- [11] G. L. Sievers, A. Abebe, Rank estimation of regression coefficients using iterated reweighted least squares, *Journal of Statistical Computation and Simulation* 74 (11) (2004) 821–831.
- [12] J. Jaccard, C. K. Wan, J. Jaccard, LISREL approaches to interaction effects in multiple regression, no. 114, sage, 1996.
- [13] Pew, Most americans say coronavirus outbreak has impacted their lives (Sep 2020).  
URL <https://www.pewresearch.org/social-trends/2020/03/30/most-americans-say-coronavirus-outbreak-has-impacted-their-lives/>

- 335 [14] A. Hikido, S. B. Murray, Whitened rainbows: How white college students protect whiteness through diversity discourses, *Race Ethnicity and Education* 19 (2) (2016) 389–411.
- [15] M. Dennis, The skillful use of higher education to protect white supremacy, *The Journal of Blacks in Higher Education* (32) (2001) 115–123.
- 340 [16] J. Brown, M. Kurzweil, The complex universe of alternative postsecondary credentials and pathways, American Academy of Arts and Sciences Cambridge, MA, 2017.
- [17] J. Jones-Schenk, et al., Alternative credentials for workforce development, *The Journal of Continuing Education in Nursing* 49 (10) (2018) 449–450.
- 345 [18] D. Rossiter, B. Tynan, Designing and implementing micro-credentials: A guide for practitioners (2019).
- [19] R. Giuseppe, B. K. Wiederhold, The new dawn of virtual reality in health care: medical simulation and experiential interface, *Stud. Health Technol. Inform* 219 (2015) 3–6.
- 350 [20] A. C. o. Education, Ace credit-accepting institutions (Mar 2021).  
URL <https://www.acenet.edu/Programs-Services/Pages/Credit-Transcripts/Credit-Accepting-Institutions.aspx>
- [21] L. M. Burke, S. M. Butler, Accreditation: Removing the barrier to higher education reform. backgrounder. no. 2728. executive summary., Heritage  
355 Foundation (2012).
- [22] S. Weissman, Education secretary betsy devos loosens accreditor and state oversight (Nov 2019).  
URL <https://diverseeducation.com/article/158738/>
- [23] S. Miller, Legislation extends student loan repayment benefits for 5 years  
360 (Jan 2021).  
URL <https://www.shrm.org/resourcesandtools/hr-topics/>



benefits/pages/legislation-extends-student-loan-repayment-benefits-for-5-years.aspx

[24] G. Team, 15 more companies that no longer require a degree (Jan 2020).

365 URL <https://www.glassdoor.com/blog/no-degree-required/>