How Post-secondary Journalism Educators Teach Advanced CAR Data Analysis Skills in the Digital Age[1]

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Survey responses from 232 journalism educators in 33 nations were analyzed for descriptions of how they have taught a subset of the most pedagogically challenging computer-assisted reporting (CAR) skills-advanced data analysis. Respondents' programs were sorted into three instructional groupings: (1) Comprehensive programs offering coherent curricula for learning three basic and six advanced analytic reporting competencies, (2) mixed adoption programs that make data analytic learning optional and student directed, and (3) lagging programs that provide weak learning opportunities. We also statistically address U.S. versus non-U.S. contrasts, and features of U.S. programs offering analytic training also are statistically addressed. Barriers to expanding such training are discussed.

Philip Meyer noted that computer-assisted reporting (CAR) has "come to apply to such a wide variety of skills, from database searching to statistical analysis, that it needs its elements specified and standards set"[2]—underscoring the need for a clearer conceptualization of CAR skills taught in journalism education. Studies tracking CAR instructional trends have traditionally measured the frequency of various research activities involving computer technology. Research activities have included basic searches for background articles through "the Internet, CD-ROMS, commercial online databases, newspaper morgues or archives,"[3] and data analysis skills such as constructing relational databases and conducting statistical analyses.[4] Yet these two types of CAR skills—colloquially, "search" versus "analysis"—differ in complexity and instructional demands. Past research indicates key cognitive distinctions between CAR skills used for searching textual databases such as LexisNexis and those used for setting up and analyzing data. For example, searching archival databases, commonly used to check facts and develop story context, requires the systematic skills of data-

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base navigation and clear query formation.[5] By contrast, setting up a useful relational database of campaign contributions or school test scores and analyzing such data involve other skills: hypothesis formation, understanding relevant quantitative variables, data cleaning, and tabulation.[6]

Reflecting this underlying conceptual distinction, studies showed marked differences in the availability of journalism courses in these two types of CAR skills. While 92% of journalism programs train students to conduct Internet searches, only half teach spreadsheet and database software skills.[7] Even the search offerings are cursory at best: Only 12% of programs offer "multiple" research skills courses covering various forms of information search.[8] Recent program shifts toward news media convergence represent a fresh challenge to improved instruction in data analysis. Such convergence imposes even more technical training requirements[9] on faculty and students, and one study indicates such pressures might be perceived as diluting the depth of reportorial training.[10] Such trends have led some CAR scholars to voice a familiar criticism that post-secondary journalism training has become overly oriented to craft, rather than profession.[11] Although taught less frequently to journalists than search skills, data analytic CAR skills are widely recognized as important. Data analysis often distinguishes the most celebrated journalistic work,[12] and such skills serve as an important intellectual foundation for journalistic skepticism and interviewing.[13] These skills have long been considered underdeveloped among journalists,[14] so professional institutes[15] and accreditation agencies[16] call for greater numeracy/analysis to be taught by journalism educators.[17] To foster more of such instruction, CAR scholars suggest teaching data analysis skills in ways that are relevant to journalists' professional work and critical thinking dispositions.[18]

Teaching data analysis skills has been termed "daunting,"[19] and data analysis course adoptions were largely hindered by a lack of qualified faculty.[20] Further, research methods classes too often emphasize technology use—"how to do rather than how to think."[21] To better teach data analysis, some have called for a deeper approach, noting that:

> making sense of quantitative data will require that journalism programs do more to train students in social science methods, including statistical analysis, than has ever been the case historically. Both good librarianship and good social science method will be needed to change digital information into news that illuminates rather than confuses.[22] [emphasis added]

Literature is silent on preconditions that influence whether journalistic training programs have greater or lesser focus on data analysis. A few hypotheses can be advanced about the underlying conditions associated with greater access to CAR training. For example, compared to other programs, large journalism programs in doctoral universities (subsuming 60% of U.S. journalism students)[23] can offer students more access to advanced data analytic courses outside their departments. More selective journalism pro-

grams also can offer more advanced data analytic courses—because, presumably, they can assume that students perform with at least minimal capabilities and are more likely to graduate.[24] Studies have showed that a paucity of qualified faculty can limit data analytic offerings. Finally, the innumerate quality of U.S. journalism programs may be culturally based. K-12 educational studies indicate that U.S. schools lag behind many other nations in mathematical education.[25] By extension, the lack of data analysis may be more acute in U.S. journalism programs than in non-U.S. programs.

This study was designed to describe the state-of-the-art in teaching data analysis skills in journalism education. In contrast to past CAR research efforts, we specifically targeted data analysis skills, which we defined based on recent journalism research.[26] We focused on six quantitative analytic competencies: statistical conceptualizing, basic statistical computation, interpreting visual statistics, using statistical programs, interpreting Geographic Information System (GIS) maps, and creating GIS maps. For contrast, we also noted three more commonly taught digital competencies focused more on news production: publication software use, graphics editing, and the data-related skill of summarizing someone else's analytical findings.

To formulate preliminary hypotheses to frame our inquiry, we utilized the approach of past studies examining CAR instructional adoption: Rogers' framework for the dissemination of innovations in educational institutions.[27] We categorized journalism programs we surveyed by the portion of advanced data analytic skills taught. Programs teaching most or all of advanced skills were classified as "comprehensive"; those teaching some advanced skills along with the production and data summarization skills were classified as "mixed adopters"; those teaching few to none of the advanced data analytic skills—but mostly production and data summarization skills as—were classified as "lagging." We hypothesized that larger program size, greater program selectivity, and greater faculty expertise would correlate with more comprehensive data analytic programs. Our inquiry focused on the following general questions (see below for hypotheses):

(1) What kinds—and levels of—data analytic training are offered by journalism programs? How many are comprehensive, mixed-adopters, and laggards in data analytic training?

(2) Are there significant differences in the sorts and sets of advanced data analysis and digital training that journalists in the United States, compared to other countries, receive?

(3) What are the characteristics of U.S. journalism schools and instructors who offer the highest level of data analysis and digital training? Are the schools large and selective? Do instructors with more advanced analytic experience teach such skills more than do instructors lacking such experience?

Methodology

Our sampling approaches differed for U.S. and non-U.S. schools. For U.S. schools, we created a list of e-mail addresses from programs accredited by the Accrediting Council on Education in Journalism and Mass Communications (ACEJMC), which represents about 112 accredited programs—or less than a quarter of the estimated 459 U.S. colleges and universities offering journalism degrees. Focusing on accredited schools presented some risk because some research suggests that accredited programs are less flexible in course development.[28] However, we used this narrowed sample because, for the purposes of a descriptive study, we wished to increase our chances of capturing the full range of offerings in a specialized course of data analysis. In theory, ACEJMC schools guided by standards calling for quantitative skill training might offer a stronger chance of capturing the most comprehensive programs and instructors. Further, past empirical work indicated a higher survey response rate from accredited institutions.[29] We also sent e-mails to data analysis instructors known to one of the co-authors, and to CAR-oriented journalism listservs—JourEdu list, Investigative Reporters and Editors (IRE), and National Institute for Computer-Assisted Reporting (NICAR). This sampling approach, while less apt for inferential studies that characterize trends (as our respondents are likely more sympathetic to inquiries about advanced analytic and digital skills than the median journalism instructor), is appropriate for studies designed to describe a subset of instructional offerings. Initial queries went to 52 U.S. journalism schools, including eight top-rated professional programs.[30] Our respondents included instructors from 31 AEJMC-accredited institutions, or about 60% of our sample. Our total U.S. response rate from the snowball sampling technique was about 60%.

For our international sample, we sent e-mails to professional associations and personal contacts. This method led to some heterogeneous sampling across schools. For example, nine of forty English-speaking non-U.S. respondents came from a single journalism school in Denmark, a country whose secondary students have historically excelled in mathematics education relative to their American counterparts.[31] We were not always successful in obtaining sufficient responses from different nations. Since we received only four responses from Arabic-speaking educators, we removed their data from our analysis.

We developed a survey in five languages, using online groupware (SocialText) and survey software (FormSite). We posted the survey online from September through December 2005, and received 232 total responses: 81 from 25 U.S. states and one from the District of Columbia, and 151 from non-U.S. schools in 32 nations. Respondents represented 56 U.S. and 79 non-U.S. journalism programs. (For a language breakdown, see Table 1; see Appendix A for participating states, nations, and the numbers of respondents.) In reporting data, we provide breakdowns by both language groups and U.S. vs. non-U.S. institutions and language groups.

Our sample represented a wide range of postsecondary institutions (Table 2), program enrollment sizes

Table 1
RESPONDENTS' LANGUAGES (N = 232)

	N	%	Language
Non-U.S.	57	24	Spanish
	40	18	English
	34	15	Portuguese
	16	7	Hebrew
	4	2	Arabic
Non-U.S. Subtotal	151	65	
U.S.	81	35	English
TOTAL	232	100	

(Table 3), and faculty ranks (Table 4). U.S. respondents were mostly from larger programs, while non-U.S. respondents were mostly from smaller programs. Most respondents (whose mean age was 46) worked full time, were male (52%), and in the professorate.

Survey Instrument. We asked 49 questions organized in three broad categories: institutional, instructional, and personal. Twelve were multiple-

Table 2
RESPONDENTS BY INSTITUTION TYPES AND LANGUAGE GROUP (N=225)*

Institution	*Non U.S.*				*Non U.S.*	*U.S.*	*Total*	*%*
	Spanish	English	Portug.	Hebrew	(subtotal)	English		
Grad School	8	6	1		15	18	33	15
4-year University	44	11	32		87	59	146	65
3-year University	3	11		13	27		27	12
Junior College	1	3	1	3	8	2	10	4
Mid Career		3			3		3	1
Vocational		3			3		3	1
Other		3			3		3	1
TOTAL**	56	40	34	16	146	79	225	100

*Arab respondents excluded due to low response.
** Some respondents did not report their country of origin.

Table 3
RESPONDENTS BY ENROLLMENT IN JOURNALISM PROGRAM AND LANGUAGE GROUP (N=226)*

Enrollment	*Non U.S.* Spanish	English	Portug.	Hebrew	*Non U.S.* (subtotal)	*U.S.* English	*Total*	*%*
0-25	18	8	9		35	2	37	16
26-75	14	7	19		40	6	46	20
76-150	12	9	5	12	38	7	45	20
151-250	9	5	1	2	17	12	29	13
251-500	3	7		2	12	21	33	15
500+	1	3			4	32	36	16
TOTAL**	57	39	34	16	146	80	226	100

*Arab respondents excluded due to low response.
**Some respondents did not report their country of origin

choice items about one's institution. We asked about the journalism school's type (e.g., undergraduate, graduate, two-year, four-year), size, special application/admission requirements, student academic characteristics, technological infrastructure, and the existence of published standards for quantitative and digital skills. We employed 14 multiple choice and short-answer questions about the characteristics of analytic and/or digital journalism instruction, including questions about particular skills and tools taught; views on ways to teach such skills; use of digital technology and tools to manage courses and teach story research; graduation requirements and tests; and the availability and type of courses for learning about quantitative skills and digital tools for journalism inside or outside one's department. The remaining 23 multiple-choice questions were about instructors' personal characteristics. These covered gender; age; personal technology habits; current work status as a professional journalist; length of time as journalist/journalism instructor; university rank; part-time/full-time status; university training; work experience and training in quantitative/analytic journalism; and the instructor's institution name, city, and nation.

Analysis

We conducted mixed-method analyses. On the broad spectrum of qualitative analysis, which runs from highly qualitative (such as ethnography or depth interviews) to the quasi-quantitative (such as short-answer coding), our analysis was much closer to the latter. We reviewed and organized eight short-answer responses, which were then broken down by the respondent's type of institution, nation, and level of support for teaching quantita-

Table 4
PROFESSIONAL RANKS OF ALL RESPONDENTS

Rank	Percent
Dean	2
Chair	14
Professor	22
Associate Professor	15
Assistant Professor	14
Lecturer/Instructor	10
Associate Lecturer	2
Adjunct	6
Other	2
No response	13
Total	100

tive and digital skills. Two kinds of quantitative analysis were used. The first focused on providing basic descriptive information about the frequency and distribution (e.g., within a program or not) of instruction in quantitative and digital skills. The second kind of analysis focused on testing for statistically significant relations that informed our initial hypotheses, which were that (1) Larger U.S. schools may offer students more quantitative and digital opportunities than smaller schools (e.g., by referring students to other departments for instruction); (2) U.S. schools may have fewer data analysis offerings than non-U.S. schools; (3) More selective U.S. institutions may offer more data analysis opportunities than other schools; and (4) U.S. instructors with more professional data analytic experience and training (than those with less) may teach these skills more.

To test our hypotheses, we first ran chi-square analyses and ANOVAs (analyses of variance) to see whether the various dependent measures of quantitative and digital skills instruction were significantly predicted by four factors: nation, school size, school selectivity, or instructor experience. A given dependent measure was sometimes predicted by multiple factors that were correlated with one another. So, to assess whether some of the observed effects arose only due to confounding, additional stepwise regression analyses were conducted. After all other significant predictors had already been entered, each predictor was entered into a regression equation last—to see whether that last one still accounted for any further significant portion of variance. When it did, this indicated that its predictive power did not derive merely from its correlation with other significant predictors. We report results for only those statistically significant ($p < .05$) chi-square tests that are corroborated by stepwise regression analyses.

Table 5
THREE PROGRAM TYPES: ADVANCED ANALYTIC COMPETENCIES (COUNTS) TAUGHT (N=228)*

	Comprehensive			Mixed Adopter			Lagging	
# of Analytic Competencies	6	5	4	3	2	1	0	Total
Respondents	5	6	39	20	44	36	78	228
% All Respondents	2%	3%	17%	9%	19%	16%	34%	
U.S. English	2	4	11	7	18	7	20	69
Non-U.S. (subtotal)	2	2	25	12	24	25	52	142
Spanish	0	1	16	6	10	10	14	57
Non-U.S. English	2	1	7	3	10	4	8	35
Portuguese	0	0	0	0	3	10	21	34
Hebrew	0	0	2	3	1	1	9	16

*Some respondents did not report their country of origin.

Findings Related to Questions

1. With regard to kinds and levels of analytic training, programs offered a range of instructional options, as respondents' programs fell into three groups: 22% comprehensive, 44% mixed adopter, and 34% lagging (Table 5). Characterizing instructional programs by groups, we focused on some key indicators. First, we reviewed how many of the nine digital data analytic competencies they taught. These included three basic publication and data-summarizing competencies (publication software, graphics editing, and data interpretation) and six advanced data analytic competencies (listed above). Analysis showed that most of the reporting journalism programs offer instruction in publication and summarization competencies (Table 6), and a minority offer advanced analytic competencies (Table 5).

Another key indicator hinged on whether programs had admissions requirements, graduation examinations, or published standards about the analytic and digital competencies students were expected to achieve. We found that 25% of all instructors reported admission requirements for quantitative proficiency and 17% for digital proficiency; 31% reported graduation requirements for data analytic and/or digital skills. More non-U.S. programs reportedly had published standards for data analytic skills than did U.S. programs (Table 7), but there was no difference for published digital skill standards (see Appendix B for data table).

Table 6

DISTRIBUTIONS, AS FUNCTIONS OF LANGUAGE USED AND U.S. RESIDENCY, OF INSTRUCTORS REPORTING COMPETENCIES TAUGHT (ADVANCED COMPETENCIES UNDERLINED) (N=229)

Applications/ Competencies	Spanish (n=57)	Non-U.S. English (n=35)	Portug. (n=34)	Hebrew (n=16)	Non-U.S. (subtotal) (n=142)	U.S. (n=69)	Total*	%
1. Pub. Software	35	26	24	1	86	55	141	62
2. Graphic Edit.	34	21	25		80	47	127	55
3. Data Summary	34	27	10	6	77	48	125	55
4. Stat Concepts	32	20	10	6	68	41	109	48
5. Basic Stats	32	27	1	7	67	37	104	45
6. Vis. Stat. Interp.	20	16	5	2	43	27	70	31
7. Stat. Programs**	26	9		5	40	23	63	28
8. GIS Interp.	4	7			11	8	19	8
9. GIS Creation	3	2			5	4	9	4

* Some respondents did not report their country of origin. Many respondents reported teaching more than one competency.
**Statistical programs such as SPSS, SAS

Our final key indicator focused on whether a program required students to complete analytic or digital courses inside or outside one's department. As Table 8 shows, in programs that required data analytic and digital production courses, more instructors reported such courses were offered inside the department compared to outside. In programs that made such courses optional, differences were by course type: Notably more instructors reported that digital production classes were offered inside the department, but roughly equivalent numbers of instructors reported data analysis elective courses were offered either inside or outside the department. In addition, relatively more instructors reported multiple paths—either inside or outside department—for digital production training compared to data analysis. A higher number of instructors reported being unsure what data analytic offerings were available in their programs.

Comprehensive Programs. Journalism programs in the comprehensive group gave future journalists balanced and coherent opportunities to learn the nine competencies of analytic reporting and digital production. Programs' instructors described clear instructional sequences and the integrated uses of digital tools to prepare students for data analytic journalism. This group included the 22% of respondents who reported students learning four or more of the six advanced analytic competencies (Table

Table 7
INSTRUCTORS REPORTING PUBLISHED STANDARDS OF DATA ANALYTIC SKILLS

Language	Spanish	Non- U.S. English	Portu-guese	Hebrew	Non-U.S. (subtotal)	U.S. English	Total
Total*	57	35	34	16	142	70	212
No	41	26	30	9	106	60	166
Yes	16	9	4	7	36	10	46
% Yes	28%	26%	12%	44%	25%	14%	22%

* Some respondents did not report their country of origin.

5). We include in this group the 25% who reported daily use of graphics-imaging and/or publications-production software, and the 20% who reported daily use of database and/or spreadsheet software.

These instructors described programs teaching data analytic skills in a sequenced fashion that involved the strategic use of digital tools: "All students must take courses in spreadsheet use, including basic math in quantitative analytic methods and theory, and in digital data collection." And: "Students are introduced in the first writing classes to the concept of using numbers and spreadsheets to write a 'numbers' story." Students also often received integrated data analytic work with digital graphic representation

Table 8
PERCENTAGE OF JOURNALISM INSTRUCTORS REPORTING THAT STUDENTS MAY TAKE REQUIRED OR ELECTIVE QUANTITATIVE AND DIGITAL PRODUCTION COURSES INSIDE OR OUTSIDE THEIR JOURNALISM DEPARTMENT*

	Data Analytic Courses	Digital Production Courses
Inside Dept. Required	0.34	0.45
Outside Dept. Required	0.16	0.15
Inside Dept. Elective	0.32	0.44
Outside Dept. Elective	0.30	0.28
Multiple Paths	0.25	0.44
Not Sure	0.11	0.01

*n=228: 69 respondents did not select any of these categories; Of the responding 159, 71 selected only 1; 48 selected 2; 21 selected 3; 13 selected 4; 6 selected 5.

Table 9
INSTRUCTIONAL APPROACHES TOWARD ENGAGING JOURNALISM STUDENTS WITH DATA ANALYSIS

Instructional Approach	*Example*
Analyzing Public Data Using Spreadsheets and Databases	Analyzing Neighborhood Crime Reports
Teaching Interpretation of Statistical Information	Analyzing Data from U.S. Census and National Opinion Research Center
Teaching Basic Mathematics	Computing Percentage Change
Writing Stories from Statistical Sources	Reviewing Business Reports
Creating Surveys and Analyzing Data Using Statistical Software	Polls

tools: "I teach a graphic comm [sic] course so the students learn how to take scientific info and present creatively in layouts." And: "Some [skills], such as numeracy, are both integrated into a required editing course and are part of a required research methods course. New students must now also take a visual communications principles course that incorporates design..." The faculty members also preferred to teach quantitative and digital skills in a laboratory style: "Hands on. But mix between lectures, classroom teaching, and workshop." And: "Hands on training in combination with lectures." Such faculty listed many approaches to engage student reporters in using data to inform their work (see Table 9).

Mixed Adopter Programs. Journalism programs in the mixed adopter group provided some chances to learn to use data analytic and digital tools, but there was no clear requirement; it was often up to the student to find such opportunities. This mixed group comprised 44% (the plurality) of respondents—those who reported that their programs taught students 1 to 3 of the six advanced analytic competencies (Table 5). This portion includes the 7% of instructors who reported that their programs offered students either statistical or production courses—but not both—and instructors who described teaching data analytic skills mainly through lecture and seminar classes in statistics.

These instructors favored having students learn data analytic skills by taking elective courses in other departments. One professor wrote: "Journalism majors are predominantly word-oriented. They shy away from quantitative topics. We encourage them to improve those aspects of their subject mastery through courses elsewhere in the liberal arts college." Some instructors reported that directing students to statistics training in other departments permitted their department to focus on

Table 10

PERCENTAGE OF U.S. AND NON-U.S. INSTRUCTORS REPORTING THAT STUDENTS MAY TAKE A QUANTITATIVE COURSE OUTSIDE THE DEPARTMENT AS AN ELECTIVE ONLY, A REQUIRED COURSE ONLY, OR AS BOTH AN ELECTIVE OR REQUIRED COURSE

	Required Outside	Elective Outside	Both Outside	Total %
Non-U.S.	0.05	0.18	0.05	0.27
U.S.	0.11	0.27	0.19	0.57

*n = 228

using digital tools for production-oriented uses, such as chart design.

These respondents described their programs' data analytic instruction as often being piecemeal, with students learning data analytic skills largely through what one instructor called "one-day stands"—one-time specialized courses. An instructor wrote: "Only one person does anything quantitative, so students get a little very basic instruction in one course only." Another characterized it as: "The usual mess really. Different people do different things in different ways when the topic comes up." A third said that quantitative skills "are taught weakly as units within classes, but not in a coordinated way. We used to have an arrangement with the math department, but the class gradually lost relevance." Some departments yield such training through "guest lectures or by visiting the national bureau of statistics." Several faculty members reported data analytic courses being offered mainly to graduate students: "Undergrads have limited access to these skills," as one instructor put it. The skills are "taught to undergrads who take a sales marketing course," explained another.

Lagging Programs. Journalism programs in the lagging group provided no opportunity for future reporters to learn advanced data analytic skills, and digital tools were only used for production. This group represents 34% of instructors who reported no instruction in the six advanced analytic competencies (Table 5). They often described political infighting over whether to include data analytic courses and/or strong student resistance to such courses. For instance, one instructor described a program as having "no real requirements in analytic skills—just the typical 6 or 9 credits of math. Most students test out of the requirement, but they do not know how to use a spreadsheet and they have no statistical skills or knowledge." Others described departments in transition, for which "the issue of quantitative vs. qualitative research skills is a huge debate." Even as some

faculty push to update computer-assisted reporting classes "focusing on math and statistical skills as they relate to journalism," others described efforts to eliminate such courses to focus on remedial writing instruction: "There is no longer a requirement for a quantitative methods course—a huge shortcoming. It was sacrificed for more writing classes since incoming students seem to have less exposure to grammar and writing mechanics than in years past." Some respondents openly questioned whether such skills were necessary for reporting at all.

Instructors in these lagging programs offered courses mainly in digital production, such as graphic image editing and publications software. Several survey respondents justified the lack of analytic focus by describing journalism students as "math phobic" and faculty as lacking expertise in quantitative analysis and the use of associated digital tools. Faculty members reported students often lacking basic skills calculating percentages. "Many students resist taking courses in statistics," one instructor reported. Another wrote: "We do not emphasize it enough. Faculty members do not know the subject well enough to teach it and make it a priority. I blame it on faculty with other interests." One instructor reported: "These skills are I believe taught by a couple of professors who are considered 'tough' and not particularly popular with students."

2. With regard to training advanced data analysis and digital training in the United States versus other countries, evidence showed that non-U.S. schools more often incorporated data analytic instruction in their departmental offerings than U.S. schools. For example, we found that 57% of U.S. respondents reported that their programs required students to take data analytic courses outside their departments, but only 27% of non-U.S. respondents did so (χ^2 (1, 217) = 19.35, $p < .001$). This finding was further supported, as the U.S./non-U.S. distinction was a significant predictor ($p < .05$) when entered last into the stepwise regression equation. In addition, a strong difference was found between U.S. and non-U.S. respondents in how much they allowed students to take such courses as electives outside the department: U.S. schools permitted it more (χ^2 (1, 217) = 16.90, $p < .001$)—although stepwise regression failed to confirm nationality as a significant predictor of offering such extra-departmental electives (see Table 10). We also found a significantly higher proportion of non-U.S. instructors (40%) than U.S. instructors (8%) reporting that their journalism students had to take proficiency tests in data analytic and/or digital skills to graduate (χ^2 (1, 198) = 6.82, $p < .001$). This result was also supported by stepwise regression analysis.

3. With regard to characteristics of U.S. journalism schools and instructors, and how they relate to teaching the highest levels of data analysis and digital training, program size seems to matter in one respect: programs with fewer than 150 enrolled students were significantly more likely to publish standards for quantitative analytic skills (χ^2 (1, 72) = 7.13, $p < .05$). We also found that the more selective programs, which required an extra general application from students for admission, taught significantly more basic statistics (χ^2 (1, 72) = 9.35, $p < .05$). About 51% of U.S. respondents reported that their journalism programs had

separate admission standards. Here we again report only those chi-square results that are supported by stepwise regression analyses. One relation that was just shy of such statistical significance suggests that U.S. instructors with more analytic professional background taught such skills more frequently than those without (χ^2 (1, 70) = 3.67, p =.055).

Discussion

Our study provides an overview of current practices for training future journalists in data analysis, a much-neglected subset of CAR skills. Since this work is based on a sample that somewhat favored U.S. journalism programs accredited by the ACEJMC, and a sample of convenience drawn from non-U.S. programs, its findings are probably not representative of typical practices or trends. Yet, the study does provide a descriptive review of what different kinds of data analytic programs look like and what institutional preconditions are associated with the stronger programs. Comprehensive programs offer hands-on, coherent curricula that develop data analytic skills over time and through multiple departmental courses; they tend to be smaller and more selective. Mixed adopter programs make data analytic learning opportunities available, but the student must largely seek them out; most often, the student will be learning outside the department, a situation that raises questions about how well students learn to apply such skills to journalistic work. Lagging programs offer few data analytic learning opportunities and are marked by internal disagreement over whether to emphasize such skills and therefore risk alienating "math-phobic" journalism students.

These findings offer a benchmark by which journalism educators may gauge the comprehensiveness of their current data analytic course offerings. Against the backdrop of a profession in flux, in which the skills and dispositions required to succeed are changing rapidly to include convergent newsroom technologies and entrepreneurialism, these results provide a way to examine course offerings anew and consider fresh ways to prepare graduates for a future that remains very much on the drawing board. In a context of increased competition among information sources, journalistic training may need to distinguish its value in more than the usual ways of reporting, storytelling, and information packaging. Making sense of the overload of information may become a more valued skill in this environment, and data analytic skills seem central to building such sense-making capacities.

Data indicate that U.S. journalism programs offer fewer departmental opportunities and testing requirements for data analytic education than do non-U.S. programs. This finding offers some limited support for the view that U.S. journalism schools might have some cultural resistance against formalizing requirements for data analytic training. Ample qualitative evidence exhibited this resistive mind-set: concerns about "mission drift" away from basic writing skills, fears of alienating prospective students, and worries about finding properly trained faculty. From these results, this type of faculty resistance to numeracy in journalism appears to be a key barrier that U.S. accredited journalism schools face

when contemplating how—and how much—to offer data analytic educations to their students. To foster a greater inclusion of data analytic sensibilities in reporting, journalism administrators may need to approach faculty by offering them opportunities for support and professional development. Future research may focus on developing menus of options for engaging more faculty members in seamlessly incorporating various levels of data analysis into their courses.

European journalism educators have viewed the U.S. support for "specialized" journalistic training as an advantageous precondition for building data analytic CAR skills.[32] This study indicates how such U.S. specialization occurs—the development of the comprehensive, small, and selective programs described by about 22% of our respondents. Future research might further examine the paths these comprehensive programs pursued, especially should they indeed prove superior in their capacity to prepare excellent journalists. Further, the comparison with non-U.S. educators suggests that these specialized U.S. programs develop in spite of a generally stronger resistance to formalizing data analytic training among U.S. journalism educators than their non-U.S. counterparts. Future study might examine the link between the levels of post-secondary data analytic training offered in specific nations compared to the relative frequency of CAR stories in the corresponding national press. In a global, Internet-based economy in which job outsourcing is a warranted fear for U.S. residents, including local newspaper reporters, U.S. journalism schools have a responsibility to ensure that their graduates are prepared to inform their citizens with the same level of sophistication as non-U.S. journalists.

Appendixes and Endnotes follow.

Appendix A

PARTICIPATING U.S. (25) STATES AND ENGLISH-SPEAKING NON-U.S. (14) COUNTRIES AND NON-ENGLISH-SPEAKING NON-U.S. (18) COUNTRIES

U.S. State	#	English-speaking non-U.S. Countries	#	Non-English-speaking non-U.S. Countries	#
Illinois	7	Denmark	9	Brazil	24
California	4	Sweden	5	Venezuela	18
Colorado	4	Australia	4	Israel	14
Florida	4	Norway	4	Spain	7
Iowa	4	Canada	2	Argentina	5
New Jersey	4	Greenland	2	Mexico	3
Indiana	3	South Africa	2	Portugal	2
Michigan	3	United Kingdom	2	Peru	2
Oregon	3	China	1	Mozambique	1
Pennsylvania	3	Czech Republic	1	Colombia	1
Arizona	2	Estonia	1	Ecuador	1
Maryland	2	Iceland	1	French West Indies	1
Minnesota	2	India	1	Honduras	1
Missouri	2	Netherlands	1	Panama	1
Nevada	2	TOTAL	36**	Paraguay	1
New York	2			Puerto Rico	1
Ohio	2			Egypt	1
South Carolina	2			Saudi Arabia	1
Texas	2			TOTAL	85***
Virginia	2				
Alabama	1				
Arkansas	1				
Kansas	1				
Massachusetts	1				
Washington	1				
Washington, DC	1				
TOTAL	65*				

* 16 U.S respondents did not provide state information. **Four English-speaking country respondents did not provide their country of origin. ***23% of foreign, non-English respondents did not provide country information.

Appendix B

INSTRUCTORS REPORTING PUBLISHED STANDARDS OF DIGITAL SKILLS

Language	Spanish	Non-U.S. English	Portuguese	Hebrew	Non-U.S. (subtotal)	U.S. English	Total
Total*	57	35	34	16	142	69	211
No	44	20	32	11	107	52	159
Yes	13	15	2	5	35	17	52
% Yes	23%	43%	6%	31%	25%	25%	25%

*Some respondents did not report their country of origin.

Endnotes

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