Who Needs to Code?
Developing a Coding Practice in a Media Organization

Cindy Royal, Ph.D.
Professor and Director, Media Innovation Lab
School of Journalism and Mass Communication
Texas State University
croyal@txstate.edu

Allie Kosterich, Ph.D.
Assistant Professor
Gabelli School of Business
Fordham University
akosterichsalomone@fordham.edu

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Executive Summary

New roles have emerged in journalism that support the development of media products to meet audience needs through engagement, interactivity, multimedia and data. As the complexity of these products increases in terms of technology, presentation, data and content, new skills and competencies become essential to the future sustainability of media organizations. Computer programming, or what is commonly known as coding, is an area of skill in which media organizations need to better understand and develop a range of professional practices. This report, an exploratory study of news product managers and leaders, examines their insights into the desired or optimal ways in which coding competencies are practiced in media organizations. Results yield a range of coding practices across relevant position categories and indicate programming language choice and optimal competency levels. Comments from respondents provide insight into how these practices are influencing journalism production, culture and education. These trends become critical as media organizations seek future sustainability in an increasingly competitive, digital-product environment.

Report Highlights

- A survey was sent to 37 professionals identified as product managers in media organizations derived from the membership of the News Product Alliance, with 19 responding. The survey assessed their insights on affected roles, programming language categories and competency levels of coding skills in media organizations.
- Roles in newsrooms affected by coding were identified as Data Journalists, News Application Developers, Other Web/Mobile Developer/Software Engineer, User Experience Designer, Graphic Designer, Social Media/Engagement Specialist, Product Manager and Product Director/Officer. The survey also sheds light on the coding competencies that traditional journalists and newsroom leadership could find useful.
- The survey assessed coding competencies across seven programming language categories: Markup; Frontend Frameworks; Frontend Interactive languages; Interactive Libraries or Frameworks; Server-side languages and/or Frameworks; Database Management languages or systems; and Data Analysis languages. Coding competency levels were assessed as Regular Practice, Limited Application and Conceptual Understanding.
- The most common language category expected across position types was for the Markup Languages of HTML/CSS. The second most common language category was for Frontend Interactive languages, like JavaScript.
- Those with the highest expectation of regular coding practice, or what we have termed "Super Coders," were News App Developers, Other Developers and Data Journalists. News App Developers were rated highly for Regular Practice for Markup (89.5%) and Frontend Interactive languages (78.9%), as well as Frontend Libraries and Frameworks (78.9%), emphasizing their role in creating interfaces. Other Developers had high ratings for Regular Practice across most language categories. Data Journalists were rated highly for Regular Practice in the data-related languages of Database Management (68.4%) and Data Analysis (89.5%), reflecting the data-intensive nature of this role.

- Respondents indicated little to no expectation in Regular Practice for both Product Manager and Product Director/Officer roles. However, those in product positions were expected to have a Conceptual Understanding of Markup (Product Managers - 42.1%; Product Directors/Officers - 57.9%). Product Managers were rated slightly higher in terms of Limited Application of Markup skills (47.4%), with Product Directors/Officers rated 42.1% for Limited Application. Product professionals were expected by most respondents to have at least Conceptual Understanding within every language category.
- In comparing the means for both Product Managers and Product Leaders (Directors/Officers) with the ratings that the product professionals had of their own coding competencies, in all cases, respondents rated their own coding competency slightly higher than their expectations for these roles, but those differences were only significant in the Markup category.
- The Graphic Designer role had low ratings in Regular Practice knowledge of any of the languages, but more than half of the respondents rated Markup as Limited Application (36.8%) or Regular Practice (26.3%).
- In most of the languages categories, the UX Designer role was more like Product Manager and Product Director/Officer than the Graphic Designer role in that there is an expectation by many respondents that they have a Conceptual Understanding of the Frontend Interactive and Interactive Framework languages (61.1% in both language categories). The UX Designer and Graphic Designer roles had lower ratings for any level of understanding of the data-oriented languages.
- More than a third of respondents expected a Conceptual Understanding of Data Analysis Languages for Social Media/Engagement Specialists. 36.8% of respondents indicated that Other Journalists should have a Conceptual Understanding of Data Analysis languages, and 31.6% indicated Conceptual Understanding for Database Management. This indicates a growing expectation on the usage of data in these roles, although they may be used for different reasons.
- In both Other Journalist and Other Newsroom Leadership roles, a Conceptual Understanding of Markup was rated as optimal by most respondents, and 31.6% and 26.3% of the respondents rated a Limited Application competency for those two positions respectively. This indicates shifting expectations for coding competency for even traditional journalists and news leaders.
- This exploratory study sheds light on the need for a range of coding knowledge and expertise across positions in a media organization. The results highlight implications regarding organizational structure, hiring, professional development and media education.

Read on for the full study, including respondents' comments.

Who Needs to Code?
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Introduction

Several new roles have emerged in journalism that support the development of products exhibiting the features of engagement, interactivity, multimedia and data. As the complexity of these products increases in terms of technology, presentation, data and content, new skills and competencies become essential to the future sustainability of media organizations. Computer programming, or what is commonly known as coding, is an area of skill in which media organizations need to better understand and develop a range of professional practices.

Coding is the process of developing and implementing instructions, known as algorithms, for computers to perform desired tasks. Over the past decade, coding has emerged as a desirable skill set for a range of professionals. Online coding tutorials and bootcamps at companies like Codecademy (www.codecademy.com/) and General Assembly (generalassemb.ly) have filled the need for coding education outside of university systems. Organizations like Hour of Code (hourofcode.com/us), Girls Who Code (girlswhocode.com), Women Who Code (www.womenwhocode.com) and Black Girls CODE (wearebgc.org) were launched to highlight the importance and viability of programming and to support accessibility of coding skills to marginalized groups. An emphasis on Science, Technology, Engineering and Math (STEM) education has become a pervasive preoccupation in academia.

Coding is not a single skill. It encompasses a range of languages: Hypertext Markup Language (HTML) and Cascading Stylesheets (CSS); interactive languages, like JavaScript; mobile development languages, including Swift, Kotlin and Java; server-side languages, like PHP, Python and Ruby; data-analysis languages, including SQL, R and Python; and many associated libraries and frameworks, among many other programming applications (Royal, 2017). Coding is used in different ways, at different competency levels, in different positions, for different ends. Coding skills also contribute to a logical and problem-solving mindset. The coding ecosystem continues to grow and evolve.

As news organizations integrated the formats of print and online, coding competencies were identified by professionals and scholars as a desirable and necessary skill for certain media professionals (Carpenter, 2009; Du & Thornburg, 2011; Stencel & Perry, 2016; Kosterich, 2022). Usher (2016) noted, "as journalism contends for relevancy in the digital environment, coding skills have become increasingly important" (p. 72). Powers (2012) identified the influence that changes in technology made to existing journalistic practices, but also in introducing "technologically specific forms of work" (p. 24) which are performed by new kinds of actors, initially unfamiliar in news organizations, often unwelcome in practice. The question, "should journalists learn to code?" was posed (Spinner, 2014). At the same time, criticisms of the need for teaching journalists to code were voiced (Khazan, 2013), and questions were raised regarding the legitimacy of coders in media. "What is important to recognize, however, is that such forms of work, from photojournalism of yore to programmer-journalism of today, carry certain assumptions about their journalistic legitimacy" (Lewis & Westlund, 2015, p. 22).

So, while the question about coding may have initially been, "Do journalists need to know how to code?" we find ourselves in an environment of growing product complexity with a new series of questions to consider. Which roles in a news organization needs to know how to code? What level of coding competencies are optimal for a particular role? And to what end or purpose is coding used in achieving a media organization's mission? These are a few queries explored in this report.

So, while the question about coding may have initially been, "Do journalists need to know how to code?" we find ourselves in an environment of growing product complexity with a new series of questions to consider

This study examines the ways in which coding competencies are practiced in news organizations through a survey of news product managers, or those in product-related functions, who are tasked with the management, development, testing, and launching of digital news products. Analyses are conducted on the survey results to provide an understanding of the roles in a news organization that need coding skills, why and to what degree these skills are necessary, and what value they provide. Findings contribute to practical conversations about the development of media practices in support of coding and the professionals who are expected to engage in coding practice (Ryfe, 2018).

Survey and Analysis

To understand the ways in which coding competencies are practiced in media organizations, a survey was conducted of those in product and product-adjacent positions in news organizations. Product personnel sit in a unique situation in news organizations, at the intersection of editorial, business and technology, giving them a relevant perspective on desired technology competencies across functions (Sonderman, 2016; Royal, et. al, 2020; Kosterich, 2021; Royal & Kiesow, 2021). The sample for this survey was derived by randomly selecting names from the News Product Alliance Slack. The News Product Alliance (newsproduct.org) was launched in 2020 to provide professional networking, mentorship and career development for the news product community. The NPA Slack has more than 1400 participants, but not all of the participants are news product professionals. Names were cross-referenced with position titles on LinkedIn until a set of 37 product professionals was derived. Emails were sent to the 37 individuals. Nineteen respondents completed the survey for a response rate of 51.3%.

Programming Language Categories

The survey was developed to assess competency levels of seven different Language Categories, described with examples in the survey as follows:
- Markup - i.e., Hypertext Markup Language (HTML)/Cascading Stylesheets (CSS)
- Frontend Framework - i.e., Bootstrap, Skeleton
- Frontend Interactive - i.e., JavaScript (Web) Java (Android), Swift (iOS) depending on platform
- Interactive Library or Framework - i.e., React, React Native, Vue JS, Angular JS
- Server-side language and/or framework - i.e., Python, Ruby, PHP, Rails, Django
- Database management language or system - i.e., MySQL, SQL
- Data Analysis - i.e., Python, R

- Other was also available for respondents to add categories not reflected in these descriptions

The Language Categories were partially derived from previous research by Hannaford (2015, p. 16), who asked developers and journalists about the technical skills used in their positions. Developers mentioned Frontend/User Interface (HTML/CSS, JavaScript), Backend - support systems (Python, PHP, Ruby, SQL, Unix) and Data Analysis/Presentation programs (MPS, SPSS, GIS, R). Journalists mentioned only Data Analysis/Presentations programs including Excel, Tableau, GIS and R. Non-language specific tools, like Excel and Tableau were removed for this analysis.

Position Categories

Respondents were asked to rate "optimal" coding competencies across ten different position categories found in news organizations, as follows:

- Data journalist/programmer-journalist - works with data to support journalistic storytelling.
- News application developer - develops interactive features to support journalism projects.
- Other Web/Mobile Designer/Developer and Software Engineer - develops web and mobile products that support the mission of the media organization.
- User Experience Designer - defines and develops the experiences of users on digital products.
- Graphic/Multimedia Designer - creates visual assets for media products.
- Social Media/Engagement Specialist - designs strategy and executes content associated with the media brands' social presence.
- Product Manager - manages and deploys resources associated with developing digital products.
- Product Director/Officer - leads the product function in large media organizations.
- Other Journalists and Newsroom Leadership - in a digital environment, traditional roles are affected by the presence of digital skills and coding competencies may provide value in these areas.

In an additional question, respondents were asked to rate their own competencies across language categories.

Coding Competency Categories

Bloom's taxonomy was used as a basis for developing the Competency Categories. This taxonomy is often used in developing objectives and assessing outcomes of university courses and has been used to assess computer science competencies (Ullah, et al., 2020). The taxonomy depicts cognitive assessment from general to specific, across the following dimensions: knowledge, comprehension, application, analysis, synthesis, and evaluation (Ullah, et al., 2020, p. 1629). In a modified approach, the Competency Categories derived for this analysis were described in the survey as follows, from general understanding to practical application:

- Conceptual Understanding: knowing what is possible; able to speak the language and collaborate with tech resources; conceptual usage in position, but rare application of coding skill
- Limited Application: limited application in position; occasional application of skill
- Regular Practice: regular usage in practice in position
- Respondents were able to answer None for those positions in which no knowledge or practice of the language was expected.

For each position, there was an open-ended question for Comments, Assumptions, Justification, Thoughts on Coding Skills.

Analysis

Respondents were asked to confirm current titles in the survey. Eight respondents (42%) were in product or product-related manager roles and 11 respondents (58%) were in product director/officer roles. Fifty-two percent of respondents were from legacy news organizations (those with a print component), 32% from digital news organizations (those whose main offering was a digital product) and 16% from media chains (corporate or regional position). All respondents worked for media organizations based in the United States.

The gender representation of the respondents was 42% Female; 53% Male; 5% Non-binary. Ethnicity representation was 79% Caucasian/White; 5% Asian; 5% American Indian or Alaska Native and 11% describing themselves as Other. While a more diverse sample was desired, and diversity was more broadly represented in the persons to whom emails were originally sent, the lack of diversity in our sample is reflective of the current state of news product professionals.

Results

Table 1 shows the percentage of respondents who indicated the coding competency for each of the seven language categories for the ten positions. Means were also calculated for each Language Category by applying the following coding scheme to the Competency responses: Regular Practice - 3; Limited Application - 2; Conceptual - 1; None - 0. The total score was calculated by adding the means for each of the seven Language Categories for each position, with scores ranging from 2.75 – 17.26 out of 21, providing an additional method for comparing coding competencies across positions. For each Language Category, the competency with the highest percentage is highlighted in gray.

The analysis of Competency Categories highlights the prevalence of coding skills in a media organization. By following the highlighted positions, one can see the ways in which coding competencies move from practical to conceptual by position and begin to illustrate how coding skills support the mission and objectives of specific functions. Several trends emerged from this analysis.

Table 1 Percentages and Means for Competency Categories by Language Type

Data Journalist	% Practice	% Limited	% Concept	% None	Mean
HTML/CSS	36.8%	52.6%	10.5%	0.0%	2.26
Frontend FW	5.3%	26.3%	47.4%	21.1%	1.16
Frontend Interactive	26.3%	26.3%	31.6%	15.8%	1.63
Interactive FW	15.8%	31.6%	47.4%	5.3%	1.58
Server-side	36.8%	26.3%	26.3%	10.5%	1.89
Database Mgmt	68.4%	10.5%	21.1%	0.0%	2.47
Data Analysis	89.5%	0.0%	10.5%	0.0%	2.79
Total					13.79

Social/Engagment	% Practice	% Limited	% Concept	% None	Mean
HTML/CSS	36.8%	52.6%	10.5%	0.0%	1.47
Frontend FW	0.0%	0.0%	15.8%	84.2%	0.16
Frontend Interactive	0.0%	5.3%	10.5%	84.2%	0.21
Interactive FW	0.0%	0.0%	10.5%	89.5%	0.11
Server-side	0.0%	5.3%	5.3%	89.5%	0.16
Database Mgmt	0.0%	5.3%	26.3%	68.4%	0.37
Data Analysis	0.0%	10.5%	36.8%	52.6%	0.58
Total					3.05

News App Developer	% Practice	% Limited	% Concept	% None	Mean
HTML/CSS	89.5%	10.5%	0.0%	0.0%	2.89
Frontend FW	27.8%	61.1%	5.6%	5.6%	2.11
Frontend Interactive	78.9%	21.1%	0.0%	0.0%	2.79
Interactive FW	78.9%	21.1%	0.0%	0.0%	2.79
Server-side	36.8%	47.4%	15.8%	0.0%	2.21
Database Mgmt	26.3%	63.2%	10.5%	0.0%	2.16
Data Analysis	21.1%	47.4%	31.6%	0.0%	1.89
Total					16.85

Product Manager	% Practice	% Limited	% Concept	% None	Mean
HTML/CSS	10.5%	47.4%	42.1%	0.0%	1.68
Frontend FW	0.0%	10.5%	78.9%	10.5%	1.00
Frontend Interactive	0.0%	21.1%	78.9%	0.0%	1.21
Interactive FW	0.0%	5.6%	83.3%	11.1%	0.89
Server-side	0.0%	10.5%	73.7%	15.8%	0.95
Database Mgmt	0.0%	15.8%	63.2%	21.1%	0.95
Data Analysis	5.3%	5.3%	68.4%	21.1%	0.95
Total					7.63

Other Developer	% Practice	% Limited	% Concept	% None	Mean
HTML/CSS	73.7%	26.3%	0.0%	0.0%	2.74
Frontend FW	73.7%	15.8%	5.3%	5.3%	2.58
Frontend Interactive	89.5%	10.5%	0.0%	0.0%	2.89
Interactive FW	78.9%	21.1%	0.0%	0.0%	2.79
Server-side	63.2%	36.8%	0.0%	0.0%	2.63
Database Mgmt	36.8%	36.8%	26.3%	0.0%	2.11
Data Analysis	21.1%	21.1%	47.4%	10.5%	1.53
Overall Mean					17.26

Product Director/Officer	% Practice	% Limited	% Concept	% None	Mean
HTML/CSS	0.0%	42.1%	57.9%	0.0%	1.42
Frontend FW	0.0%	10.5%	78.9%	10.5%	1.00
Frontend Interactive	0.0%	21.1%	78.9%	0.0%	1.21
Interactive FW	0.0%	0.0%	94.7%	5.3%	0.95
Server-side	0.0%	5.3%	89.5%	5.3%	1.00
Database Mgmt	0.0%	21.1%	63.2%	15.8%	1.05
Data Analysis	0.0%	15.8%	73.7%	10.5%	1.05
Overall Mean					7.68

UX Designer	% Practice	% Limited	% Concept	% None	Mean
HTML/CSS	33.3%	50.0%	16.7%	0.0%	2.17
Frontend FW	0.0%	33.3%	44.4%	22.2%	1.11
Frontend Interactive	16.7%	22.2%	61.1%	0.0%	1.56
Interactive FW	11.1%	22.2%	61.1%	5.6%	1.39
Server-side	0.0%	5.6%	50.0%	44.4%	0.61
Database Mgmt	5.6%	11.1%	27.8%	55.6%	0.67
Data Analysis	5.6%	5.6%	22.2%	66.7%	0.50
Total					8.00

Other Journalist	% Practice	% Limited	% Concept	% None	Mean
HTML/CSS	0.0%	31.6%	52.6%	15.8%	1.16
Frontend FW	0.0%	5.3%	10.5%	84.2%	0.21
Frontend Interactive	0.0%	5.3%	21.1%	73.7%	0.32
Interactive FW	0.0%	5.3%	15.8%	78.9%	0.26
Server-side	0.0%	5.3%	5.3%	89.5%	0.16
Database Mgmt	0.0%	15.8%	31.6%	52.6%	0.63
Data Analysis	5.3%	15.8%	36.8%	42.1%	0.84
Total					3.58

Graphic Designer	% Practice	% Limited	% Concept	% None	Mean
HTML/CSS	26.3%	36.8%	31.6%	5.3%	1.84
Frontend FW	0.0%	15.8%	47.4%	36.8%	0.79
Frontend Interactive	10.5%	10.5%	36.8%	42.1%	0.89
Interactive FW	0.0%	15.8%	31.6%	52.6%	0.63
Server-side	0.0%	5.3%	5.3%	89.5%	0.16
Database Mgmt	0.0%	5.3%	5.3%	89.5%	0.16
Data Analysis	0.0%	5.3%	5.3%	89.5%	0.16
Total					4.63

Other Newsroom Leadership	% Practice	% Limited	% Concept	% None	Mean
HTML/CSS	0.0%	26.3%	47.4%	26.3%	1.00
Frontend FW	0.0%	0.0%	21.1%	78.9%	0.21
Frontend Interactive	0.0%	0.0%	31.6%	68.4%	0.32
Interactive FW	0.0%	0.0%	15.8%	84.2%	0.16
Server-side	0.0%	0.0%	16.7%	83.3%	0.17
Database Mgmt	0.0%	0.0%	36.8%	63.2%	0.37
Data Analysis	0.0%	5.3%	42.1%	52.6%	0.53
Total					2.75

Everyone Should Know Some Markup

The most common type of coding competency expected across position types was for the Markup Languages of HTML/CSS. Table 2 shows the totals calculated for means across positions for each Language Category. Language Category scores ranged from 9.94-18.64 out of 30.

Table 2: Total Score by Language Category

Language Category	Total
Markup - HTML/CSS	18.64
Frontend Interactive	13.03
Interactive Library/Framework	11.55
Database Management	10.93
Data Analysis	10.82
Frontend Framework	10.33
Server-side language and/or framework	9.94

As expected, News App Developers and Other Developers had the highest rating for Markup as Regular Practice (89.5% and 73.7% respectively). Data Journalists had a higher expectation of Regular Practice than other positions for Markup (36.8%), but most rated the optimal competency in this area as Limited Application (52.6%). For Social Media/Engagement Specialists and UX Designers, Limited Application of Markup was rated as optimal by half of the respondents (52.6% and 50% respectively). Respondents were split on the competency level of Markup for Graphic Designers. More than 1/3 rated this competency as Limited Application (36.8%), but 31.6% rated Conceptual Understanding and 26.3% rated Regular Practice as optimal, indicating a shifting role in terms of coding expectations for those in Graphic Designer positions and the possibility that these roles are beginning to adopt UX functions.

Those in product positions were expected to have a Conceptual Understanding of Markup (Product Managers - 42.1%; Product Directors/Officers - 57.9%), but Product Managers were rated slightly higher in terms of Limited Application of these skills (47.4%), with Product Directors/Officers rated 42.1% for Limited Application. The smaller numbers in Regular Practice for product personnel reflect the more strategic nature of the product role, while still indicating the need for conceptual appreciation.

> *Fundamentally, I think anyone using a CMS should have a basic understanding of markup*

There were very few respondents that answered None to Markup for any position, but those responses were mostly attributed to Other Journalist and Other Newsroom Leadership roles. But even in those positions, a Conceptual Understanding was rated as optimal by most respondents, and 31.6% and 26.3% of the respondents rated a Limited Application competency for those two positions respectively. This indicates shifting expectations for coding competency for even traditional journalists and news leaders, particularly in the Markup area.

Comments from respondents regarding Markup Languages provided further insight into the need for this competency across roles. Respondents emphasized the value of having more traditional journalists with stronger coding competencies, primarily in regard to practice and collaboration with technology resources. As one product manager from a legacy news organization noted, "Fundamentally, I think anyone using a CMS should have a basic understanding of markup."

According to another product manager at a media chain,

> I marked markup languages rather high, because I believe having a deeper tech understanding on the editorial side of the newsroom would help bridge gaps in thinking and goals between editorial and product. When a journalist pitches a concept to the product team, having a deeper understanding of the tech that could be used to execute that concept helps both sides evaluate a problem quicker.

Similar explanations regarding the importance of cross-departmental or cross-role communication were prominent throughout the responses. Indeed, as one product leader noted, "The more an editor can speak the language of engineers, the better they can engage with the presentation of work on the web and edit technical stories. But modern CMSs have eliminated much of the need for editors to code."

In particular, with regard to news leadership, the sentiments regarding coding competencies dealt with the broad need for it related to decision-making and process delegation. As one product manager explained, "It is becoming more and more important for newsroom leaders to have conceptual knowledge of coding concepts so that they can make better informed decisions and prioritize work appropriately."

The Super Coders

Analysis of mean totals by position identifies those that require the highest level of coding competencies. These "Super Coders" were News App Developers (16.85/21), Other Developers (17.26/21) and Data Journalists (13.79/21). As noted above, the requirements for Data Journalists to know HTML/CSS were mostly in the Limited Application category, but Data Journalists were rated highly in the data-related languages of Database Management (68.4%) and Data Analysis (89.5%), reflecting the data-intensive nature of this role.

News App Developers had a higher rating in Frontend Interactive Languages and Frontend Libraries/Frameworks, both rated as 78.9% for Regular Practice. Other Developers had a high percentage of Regular Practice responses for all Language Categories, with the exception of Data Analysis languages (21% Regular Practice), but this role was still expected by many to have a strong Conceptual understanding (47.4%) in this area. Database Management languages were split for Other Developers with 36.8% ratings in both Regular Practice and Limited Application.

> " *Data journalists often partner with technologists on the product/engineering team, but they won't be successful if they need to entirely rely on these partners to support their work*

While News App Developers had lower ratings in Regular Practice for the Server-side, Data Management and Data Analysis languages, these positions were still expected to have a Limited Application understanding of these areas (47.4%, 63.2%, 47.4% respectively). This data shows a delineation of responsibilities across these positions. Figure 1 provides a comparison of the coding competency expectations for those in these Super Coder positions.

Figure 1: Super Coder Language Competency Comparison
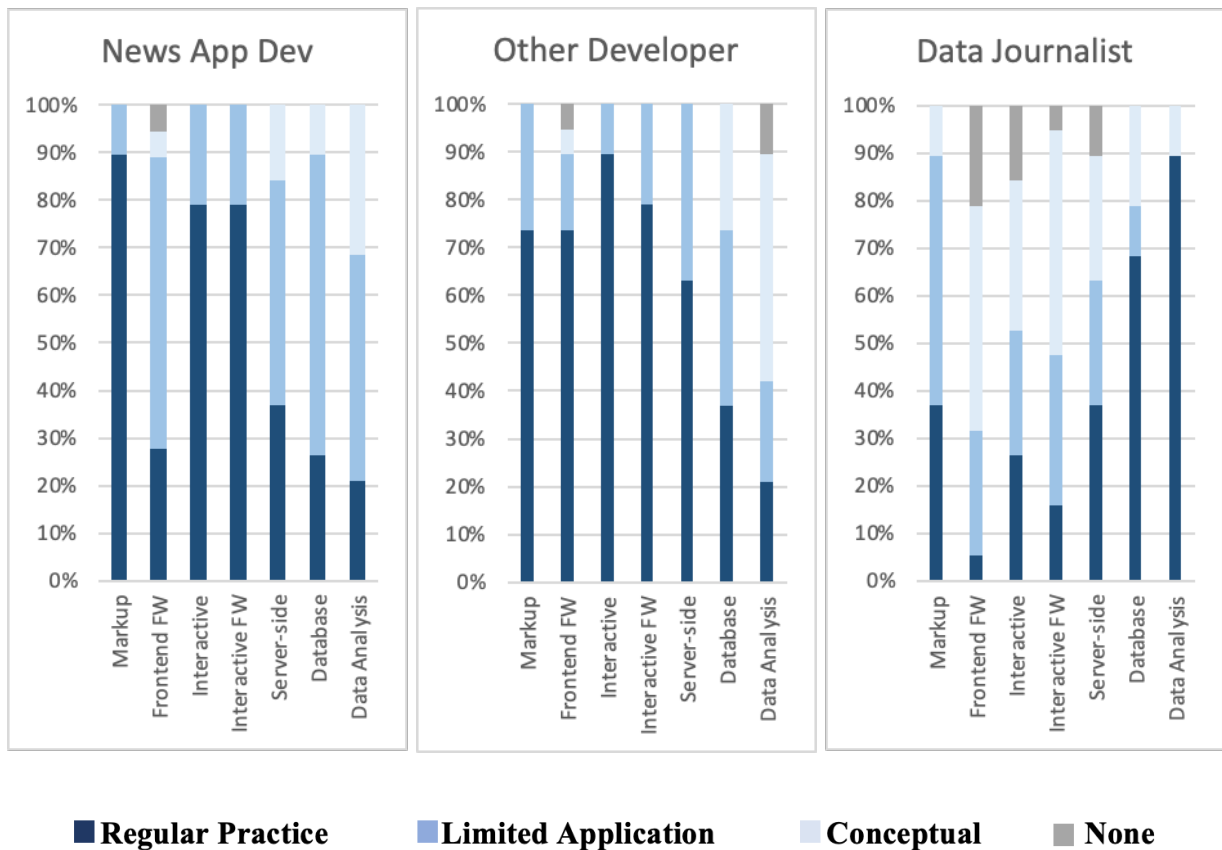
News App Developers had a higher Regular Practice focus on the frontend languages that create interfaces, and Data Journalists ratings for Regular Practice were more centered on data analysis languages that augment storytelling. Other Developers, who may work on a range of projects and tools, had a high Regular Practice rating across all language categories, but had a lower expectation of both Regular Practice and Limited Application in Data Analysis languages.

In some organizations, however, the Data Journalist and News App Developer roles may be merged and performed by the same person. Indeed, according to one product manager at a legacy news organization,

> For organizations that do not separate 'data journalists' in the analysis/newsgathering sense from those in data presentation, the level of coding skill required for a data journalist is significantly higher. They must be able to interpret and process data as well as display it.

In many cases, data journalists partner with those in technology roles to support their projects; however, respondents indicated a need for data journalists to have a general understanding of coding concepts to be able to fully collaborate on these teams. "Data journalists often partner with technologists on the product/engineering team, but they won't be successful if they need to entirely rely on these partners to

support their work," explained a product leader at a legacy organization. Indeed, it will be important for future hiring practices to determine the skills necessary to be successful across these Super Coder functions.

Trends in Product, User Experience and Graphic Design

Respondents indicated little to no expectation in Regular Practice for both Product Manager and Product Director/Officer, but were expected to have at least Conceptual Understanding of every language category. As mentioned above, both Product Managers (47.5%) and Product Directors/Officers (42.1%) were expected by many respondents to have a Limited Application competency of Markup.

Like the Other Newsroom Leadership positions mentioned above, coding knowledge for product managers was most frequently described with regard to improving communication, collaborating with technology personnel, and contributing to problem solving. According to one product manager at a legacy organization, "Product leaders can be less technical, but they need to know enough to quickly dig into big problems, gauge high-level estimates, and articulate resource needs."

According to another product manager at a media chain,

> Conceptual knowledge is key here, as the product manager must be able to translate requirements between designers, developers and other stakeholders. In my experience, enough knowledge to potentially troubleshoot some front-end code is welcomed and helps the product manager better understand bugs/errors and describe those issues to the appropriate teams.

Respondents pointed out that while product professionals may not practice coding skills in their current role, coding competencies were critical in progressing to their current position. As one product leader at a legacy news organization explained,

> I feel like I had to be good at something specific in order to get to this position. As it happens, I'm pretty good at reading code, like Python, JavaScript, HTML, CSS, understanding how code works, how GitHub works, etc. Unless you really get this, it's hard to manage and talk to people who do the work.

" I think to have that kind of leadership position you must have actually built things hands –on – either as a designer or engineer – for some time, to qualify

The necessity of understanding these skills in order to be in a management position was echoed by another product leader,

> I haven't been a practicing designer/developer for several years, but when I was, my skill level in Markup, frontend framework, frontend interactive, interactive library/framework, server-side was expert/regular practice and data analysis was limited application. Several years managing has softened my skills. But I think to have that kind of leadership position you must have actually built things hands-on – either as a designer or engineer – for some time, to qualify.

In most of the languages categories, the UX Designer role was more like Product Manager and Product Director/Officer than the Graphic Designer role in that there is an expectation by many respondents that they have a Conceptual Understanding of the Frontend Interactive and Interactive Framework languages (61.1% in

both language categories). UX Designers also had a higher number of responses for the Limited Application of Frontend Frameworks (33.3%), further indicating a need for a stronger understanding of tools that apply CSS classes for interface development; the UX Designer role was less likely to be rated highly for any level of understanding of the data-oriented languages.

Respondents provided a range of reasons for UX designers to have coding competencies, but also mentioned other technology-based skills such as framework knowledge for building prototypes, data visualization, and data analysis for UX research and A/B tests. As one product manager noted,

> The best UX designers I have worked with are those that can write their own CSS or are extremely familiar with the limitations of different browsers. Frontend Framework is a "nice to have" for this role but much can be accomplished with interactive prototyping tools like Figma or Adobe XD.

"*It's becoming more and more expected in my experience that designers can code their own work*

The Graphic Designer role was less likely to be expected to have Regular Practice knowledge of any of the languages, but more than half of the respondents rated Markup as Limited Application (36.8%) and Regular Practice (26.3%) combined. Respondents gave a relatively high rating for Conceptual Understanding of Frontend Interactive Languages (36.8%) and Frontend Interactive Frameworks (31.6%) for Graphic Designers. According to one product leader at a legacy organization, "It's becoming more and more expected in my experience that designers can code their own work."

As another product leader explained,

> Much like the UX designer, the graphic designer should have enough coding knowledge to successfully communicate their design requirements to the appropriate developers. However, given that the graphic designer is usually focused on static pieces of graphic imagery rather than responsive site design or interactives, it's less pertinent they know coding languages beyond concepts and when to apply them.

These trends may signal a change in expectations in coding knowledge for Graphic Designers and/or the merging of this role with UX Designers in many organizations.

Rating Their Own Competencies

Respondents were asked to rate their own competencies in the positions they held. In comparing the means for both Product Managers and Product Leaders (Directors/Officers) with the ratings that the product professionals had of their own coding competencies, in all cases, respondents rated their own coding competency slightly higher than their expectations for these roles. As presented in Table 3, a t-test was applied to determine the significance of these differences. Differences were not found to be significant across most language categories, with the exception of the Markup category. This may indicate that product professionals take the application of their coding skillset for granted, but overall, they generally rated their own competencies similarly to their expectations for their positions.

Table 3: Product Managers/Leaders Own Competency vs How They Rated Positions

	Markup	Frontend FW	Interactive	Interactive FW	Server-side	Database	Data Analysis
Own Rating	2.21	1.05	1.37	1.26	1.26	1.26	1.16
Product Manager Rating	1.68	1.00	1.21	0.89	0.95	0.95	0.95
Product Director/Officer Rating	1.42	1.00	1.21	0.95	1.00	1.05	1.05
p-value Own vs Product Manager	0.017	0.789	0.466	0.094	0.209	0.208	0.384
p-value Own vs Product Leader	0.000	0.789	0.466	0.115	0.259	0.398	0.624

*highlighted areas indicate p-value < .05

Other Trends: We Need to Talk About Data

Other trends in the data shed light on the future of coding competencies in news organizations. More than a third of respondents, for example, expected a Conceptual Understanding of Data Analysis for Social Media/Engagement Specialists. Beyond Markup languages, Journalists and Other Newsroom Leadership had the majority of responses of None for understanding across language categories. However, 36.8% of respondents indicated that Journalists should have a Conceptual Understanding of Data Analysis languages and 31.6% indicated Conceptual Understanding for Database Management. This indicates a growing expectation on the usage of data in these roles, although they may be used for different reasons; for example, Social Media/Engagement Specialists would be expected to use data for analytics or Journalists might be expected to do so as it relates to storytelling.

Respondents echoed the trends in the survey with their comments regarding data. One product manager at a media chain explained that "social media specialists should have conceptual knowledge about APIs and feeds."

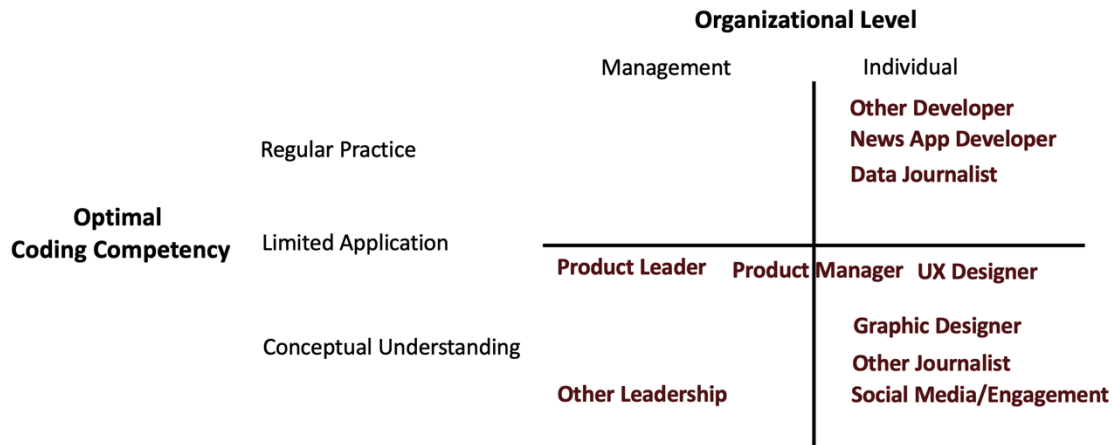> *Social media specialists should have conceptual knowledge about APIs and feeds*

Whereas, another product manager noted,
> In my experience, engagement specialists who can perform advanced data analysis with Python, R, or even SQL in Google BigQuery and Data Studio can find much deeper insights than those who cannot.

Figure 2 maps positions by deriving an overall Coding Competency score (from Table 1 above) within Organization Level (Individual or Management). Most of the positions under study were individual contributors, with the exception of Product Leaders and Other Newsroom Leadership. Product Managers were mapped across organizational levels to reflect their role in collaboration with resources across functions.

Three distinct areas of coding competency emerged. Other Developers, News App Developers and Data Journalists exist in the upper right quadrant reflecting the regular practice of coding in these Super Coder roles. Product Managers, Product Leaders and UX Designers were expected to have a Limited Application competency related to their functions. Other positions had lower coding competency expectations, although they were focused in different areas. There were no positions from this study mapped in the top-left quadrant, but this area may be reflected in technology managers and chief technology officer positions, if they exist in a media organization.

Figure 2: Optimal Coding Competency by Organizational Level

Organizational Level

	Management	Individual
		Other Developer
Regular Practice		**News App Developer**
		Data Journalist

Optimal Coding Competency

Limited Application — **Product Leader** **Product Manager** **UX Designer**

Conceptual Understanding

Graphic Designer
Other Journalist
Other Leadership **Social Media/Engagement**

Conclusion

This study examines the ways in which coding competencies are practiced in an effort to provide an understanding of the roles in a media organization that require coding skills, at what level and what value they provide. As this analysis demonstrates, when viewed as a practice in media organizations, coding itself does not define a single field, but becomes a competency desired across many fields, engaging multiple roles, but applied in the service of journalism. In some ways, coding competency creates shared values and practices, but the purposes across which coding is practiced support unique languages and processes.

Our analysis identified trends regarding the prevalence of knowing Markup Languages across positions, the type and expertise required within positions with high coding requirements (the Super Coders), the coding competencies expected of those in product and product-adjacent roles, and the unique position of Data Analysis and Data Management across some roles.

A more general view, however, of coding expertise was highlighted in some of the respondents' comments. Some respondents, for example, spoke in terms of improving coding literacy and encouraging a coding mindset across the organization. As one product leader explained,

> Coding competency could include 'literacy' or reading ability, without writing ability. From a teaching perspective, if there were such lesson plans, like 'learn enough machine learning to be able to manage an AI product development team,' or 'learn enough HTML, CSS, JavaScript, PHP and React to manage a front-end team of web developers,' that would be interesting.

Another product manager at a legacy organization added,

> I think it is important for almost all of these roles to 'think like a programmer' – beyond knowing the limitations of the language, it's important for product managers and developers to be able to think of problems in terms of loops, if statements, etc. This transcends language and framework.

The trends identified here regarding the range of coding languages and positions in which they are practiced indicate several future ramifications. First, the findings point to integrating more coding-focused training and education, which will require media educators who can include coding concepts in their lessons, not just in journalism curriculum, but also across communication fields to include public relations, advertising and design.

Second, the respondents of this survey mostly reflected media outlets with large staffs and resources. Local journalism needs were only reflected in the responses of product professionals working at media chains. But this analysis indicates the importance of these skills in media organizations as they shift to a digital product culture. Smaller and local news organizations will need to develop creative strategies for integrating coding practices, which may involve redistribution of resources and new types of consultative partnerships.

As we move away from the simple consideration of whether journalists should know how to code to more generally considering the range of roles in a media organization that benefit from knowing how to code and why, it will be essential for local media organizations to adopt new practices as they seek new business models and consider strategies for their future sustainability. "On a practice perspective, then, when we say that journalism needs a new business model, we are saying much more than that it needs to find a new way to make money. We are saying that practices of news production will change as well" (Ryfe, 2021, p. 61).

One trend this analysis does not address is the rise of no-code/low-code applications, such as Microsoft Power Apps, Glide or Flutter (Johannessen & Davenport, 2021). While these tools may make the development of digital products more accessible for some applications, the high-level skills associated with coding – problem solving, thinking like a programmer, an understanding of data – will continue to be desirable competencies. Having more people in a media organization with these perspectives only improves the ways in which user needs are addressed in increasingly innovative and useful ways.

While this exploratory study focuses on the responses of a small group of specialized professionals – media product manager and leaders – the insights gleaned from their responses and comments provide a foundation from which a media organization can start to better understand the roles that are affected by coding competency and help to develop strategies for hiring and professional development. This study also provides insights for media education to fine-tune the role of coding across media curriculum.

Future studies should expand the sample to include more positions at more media organizations. In addition, efforts should be made to gain insights from more diverse respondents in terms of geographic, cultural and ethnic backgrounds regarding unique challenges associated with coding practice. Overall, this project extends the conversation about coding skills in media organizations, as they shift to a digital, product-oriented culture.

References

Carpenter, S. (2009). An application of the theory of expertise: Teaching broad and skill knowledge areas to prepare journalists for change. Journalism & Mass Communication Educator, 64(3), 287-304.

Du, Y. R., & Thornburg, R. (2011). The gap between online journalism education and practice: The twin surveys. Journalism & Mass Communication Educator, 66(3), 217-230.

Hannaford, L. (2015). Computational journalism in the UK newsroom. Journalism education, 4.

Johannessen, C. & Davenport, T. (2021). When Low-Code/No-Code Development Works — and When It Doesn't. Harvard Business Review. June 22, 2021. https://hbr.org/2021/06/when-low-code-no-code-development-works-and-when-it-doesnt.

Khazan, Olga (2013). Should Journalism Schools Require Reporters Learn to Code. No. The Atlantic, October 21, 2013. https://www.theatlantic.com/education/archive/2013/10/should-journalism-schools-require-reporters-to-learn-code-no/280711/.

Kosterich, A. (2022). News Nerds: Institutional Change in Journalism. Oxford University Press.

Kosterich, A. (2021). Reengineering journalism: Product manager as news industry institutional entrepreneur. *Digital Journalism*, 1-30.

Lewis, S. C., & Westlund, O. (2015). Actors, actants, audiences, and activities in cross-media news work: A matrix and a research agenda. Digital journalism, 3(1), 19-37.

Powers, M. (2012). "In forms that are familiar and yet-to-be invented": American journalism and discourse of technologically specific work. Journal of Communication Inquiry, 36(1), 24–43.

Royal, C. (2017). Coding the Curriculum in Global journalism education in the 21st century: Challenges and innovations. Eds. Goodman R. S., & Steyn, E. Knight Center for Journalism in the Americas.

Royal, C., Bright, A., Pellizzaro, K., Belair-Gagnon, V., Holton, A. E., Vincent, S., Zielina, A, Heider, D. & Kiesow, D. (2020). Product management in journalism and academia. Journalism & Mass Communication Quarterly, 97(3), 597-616.

Royal, C., & Kiesow, D. (2021). From Boundary to Bridge and Beyond: The Path to Professionalization of Product Roles in Journalism. Journalism Studies, 22(11), 1546-1565.

Ryfe, D. (2018). "A Practice Approach to the Study of News Production." Journalism: Theory, Practice, Criticism 19 (2): 217–233. doi:10.1177/1464884917699854.

Ryfe, D. (2021). The economics of news and the practice of news production. Journalism Studies, 22(1), 60-76.

Sonderman, J. (2016). Best practices for product management in news organizations. https://www.americanpressinstitute.org/publications/reports/white-papers/product-management-best-practices/.

Spinner, J. (2014). The Big Conundrum: Should Journalists Learn Code? American Journalism Review. September 24, 2014. https://ajr.org/2014/09/24/should-journalists-learn-code/

Stencel, M., & Perry, K. (2016). Superpowers: The digital skills media leaders say newsrooms need going forward. Tow-Knight Center for Entrepreneurial Journalism.

Usher, N. (2016). Interactive journalism: Hackers, data, and code. University of Illinois Press. Chicago.

Acknowledgements

Cindy Royal, Ph.D.
Professor and Director, Media Innovation Lab
School of Journalism and Mass Communication
Texas State University

Allie Kosterich, Ph.D.
Assistant Professor
Gabelli School of Business
Fordham University