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Using R in Research Classes: A Challenge to Adopt New Technology to Improve Social Work Education and Clinical Practice

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Abstract: Engaging in anti-oppressive, evidence-based practice in the social work field demands preparation for research methods during social work education. However, while faculty members at institutions of higher education have access to more technology than ever before and teach graduate students who use technology constantly in their personal lives, barriers still exist that limit the implementation of these new technologies, despite benefits in accessibility and equity in doing so. This study examined faculty members' perspectives related to their use of R as a free statistical analysis tool in their teaching of research classes. Findings indicated that the primary barriers included faculty perceptions of the technology.

Keywords: Social Work Education, Social Work Practice, Technology Implementation, R Statistical Analysis

The growing popularity and emphasis on evidence-based practice necessitate research skills for social worker practitioners, both in the generation of scientifically useful evidence as to the effectiveness of social work interventions, and in the ability to read and interpret research findings generated by others. To this end, there is a relationship between relevant social work practice and research skills (Gambrill, 2012). The Council on Social Work Education has endorsed the importance of research skills, which has listed the ability to engage in research-informed practice and practice-informed research as one of ten core social work competencies (Council on Social Work Education (CSWE), 2022).

The benefits of incorporating research and EBIs in mental health settings are well documented (Aarons, Fettes, Flores, & Sommerfeld, 2009; Baer, Wells, Rosengren, Hartzler, Beadnell, & Dunn, 2009; Evans, Koch, Brady, Meszaros, & Sadler, 2013; Garland, Brookman-Frazee, Hurlburt, Accurso, Zoffness, Haine-Schlagel, 2010; Grady, Wike, Putzu, Field, Hill, Bledsoe, ... & Massey, 2018; Hoagwood, Kelleher, Feil, & Comer, 2000; Wonderlich, Simonich, Myers, LaMontagne, Hoesle, Erickson, .…Crosby, 2011). However, many mental health settings do not incorporate research on a regular basis creating a gap between research and practice, which needs to be addressed. Provider's attitudes and beliefs have a direct impact on the adoption of research and evidence-based practices in outpatient mental health clinics serving youths (Flaherty, 2019) and previous research supports that providers' positive attitudes and beliefs of EBP and EBI use can be fostered through education (Aarons, 2004; Addis & Krasnow, 2000; Addis, Wade, & Hatgis, 1999; Morrow-Bradley & Elliott, 1986; Prochaska & Norcross, 1983). Thus, it begins with the MSW instructor to begin teaching the importance of incorporating research in practice. Teaching research skills and the importance of their use in clinical practice is not enough. These skills should then be taught using programs that can then be integrated once they graduate to promote true evidence-based practice among practitioners.

Despite the need for research skills in social work, it is widely recognized that there are numerous barriers to conducting or utilizing research within social service agencies. These include a lack of knowledge by practitioners in how to conduct agency-based research and a lack of the financial resources to engage in such (Auerbach & Zeitlin, in press; Carman & Fredericks, 2010; Lunt, Fouché, & Yates, 2008). The growing emphasis on evidence-based practice has only emphasized this gap. Schools of social work are uniquely positioned to help close this gap by teaching useful and understandable research skills that will be helpful for students as they become professional social workers. In this way, social work schools can help build research capacity in practice settings.

Challenges, however, exist in an academic setting when it comes to teaching research skills. Social work students often think they are incapable of understanding mathematical concepts, so many enter research classes with preconceived negative feelings toward these courses(Schacht & Aspelmeier, 2005). These students, then, often present as unmotivated, yet research professors are charged with the daunting task of teaching complex skills to reluctant learners (Capshew, 2005). To address this, innovative teaching methods have been attempted to decrease hesitancy and improve research skills. These include making assignments relevant to students' interests, requiring students to complete research activities outside of class to improve their skills and confidence, assigning reading and interpreting scholarly articles, and the use of statistical analysis with their own clients(Capshew, 2005; Elliott, Choi, & Friedline, 2013). In this way, students are encouraged to practice skills taught in class and build their comfort with using statistical software, other research technology, and the use of research strategies(Smith & Martinez-Moyano, 2012).

Considering the demand to provide supportive evidence using technology within the social work field, coupled with the challenge to prepare social work students to feel comfortable with research solutions that are both powerful and anti-oppressive, the researchers focused on the use of *R* in preparing students for this aspect of their future role. Specifically, *R* was explored as a research tool that is omnipresent throughout the social sciences but is underused in social work. As will be discussed below, the identified barriers to adopting *R* revealed concerns that can be applied to the introduction of new technology in general.

The Case for Using R in Social Work Research Courses

R, a robust, free, open-source statistical programming language, is an underused resource in social work research courses(The R Project for Statistical Computing, n.d.). It can be used in lieu of proprietary statistical software packages such as SPSS, SAS, and Stata. *R* can be used to analyze group and time series data easily, and it can produce powerful graphs that are easily interpretable. It can be installed on almost any computing platform, making it easy for students to use regardless of whether they use personal computers or Apple products; additionally, cloud versions expand use to those using any type of platform or device.

Another benefit to using *R* with social work students is that, because it is freely available, students can easily introduce its use into their field placements and future places of employment, again increasing the research capacity within agencies by reducing identified barriers. Use of proprietary software carry with it a subscription fee, monthly or annually, that must be included in agency costs, detracting from resources that can be better allocated to the clients served. *R* allows social workers to conduct fundamental anti-oppressive research through accessible analysis software that does impact or divert limited financial resources away from agencies and the clients served. There is an absence of research in the field of social work research data analysis, with studies preferring to focus on qualitative rather than quantitative methods; however, proposed best practices in anti-racist and anti-oppressive research dictates the use of both community and agency experts in conjunction with statisticians to utilize data analysis that stays true to context of the community (Rogers, 2012; AISP, 2020).

With these benefits, the onus falls to social work programs and its faculty to introduce software that is current to the field of social science research yet accessible to social service agencies, and *R* meets these criteria.

Faculty barriers to the implementation of new technologies

Higher education is changing rapidly with the incorporation of online platforms, and COVID-19 has propelled this movement even further. Faculty members at institutions of higher education have access to more technology than ever before and are teaching graduate students who use technology constantly in their personal lives. As a result of COVID-19, academics have been required to implement new and innovative technologies in their classrooms and curricula. In higher education, technological innovation is having a transformational impact on learning, and increased technological literacy among faculty is of central importance (Mayberry et al., 2012; Zarei, Kheiri, & Yazdgerdi, 2014; Watty, Mckay, & Ngo, 2016). However, barriers still exist that limit the implementation of these new technologies.

Despite the multitude of benefits, many faculty are found to be resistant to adopting new technologies in their teaching practice (Blin & Munro, 2008; Keller, 2005; Kirkup & Kirkwood, 2005; Selwyn, 2007; Senik & Broad, 2011; Zarei, Kheiri, & Yazdgerdi, 2014; Watty, Mckay, & Ngo, 2016; Polly, Martin, & Guilbaud, 2021). Previous research indicates that the primary barriers to faculty are time commitment and workload balance. Most concerns to administrators and staff are return on investment given varying levels of communication, engagement, and student interactions (Lederman, 2017; Pomerantz & Brooks, 2017; Polly, Martin, & Guilbaud, 2021). Even when faculty agree that it would be beneficial to implement the new technologies, their perceptions of the technology prevent implementation.

As higher education institutions continue to expand their use of digital technologies, the need to provide adequate support to faculty has become increasingly more critical and acute. Providing appropriate training and workshops is the most effective support to promote the integration of new technologies in higher education. Studies have found that faculty report a preference for sessions that involve individual or small group settings, is less time intensive and involve flexibility between online resources, in person support and take faculty schedules into account (Lawless & Pellegrino, 2007; Georgina & Olson, 2008; Seale, 2014; Herman, 2012; Gappa et al., 2007). Incentives for technology use also increase use (Gappa et al., 2007), as does peer networking and community of practice (White et al., 2015; Ajjan & Hartshorne, 2008; Samarawickrema & Stacey, 2007; Kopcha, 2010) and a focus on experimentation (Johnson et al., 2012; Manrique & Manrique,2011; Polly, Martin, & Guilbaud, 2021).

Faculty perception of integrating new technologies is often the most significant barrier to implementation. This is highlighted in classes that are already challenging to teach, such as research classes focusing on statistical analysis. Faculty often resist incorporating new or unknown technologies to analyze data even if they are shown to be superior to prior technology in multiple ways. The perception of the new technology presents the most common barrier to integrating and implementing new technologies in research class. This study aimed to investigate the perceptions of faculty members towards using *R*, using an understanding of previously identified faculty perceptions of new technology as a lens to exploring barriers.

Methods

Sample and Data Collection

To understand faculty perceptions of utilizing *R* as a research tool, the researchers conducted a cross-sectional survey of research social work educators from 230 higher education institutions accredited by the Council of Social Work Education as of 2019. Anonymous surveys were distributed via SurveyMonkey to deans and directors of social work programs to be forwarded to instructors of social work research courses. Surveys included 36 questions, including five open ended questions. A list of survey questions can be found in Table 1, below. A total of 117 respondents completed the survey, a response rate of 50.1 percent.

Table 1. Survey questions.

Are you currently teaching a research methodology course or have you taught a research methodology course in the past?
If yes, what is/was the topic of the course?
Is the course face-to-face or online?
Are you using or have you used any type of statistical software to teach the course?
If yes, what package do you primarily use in this course?
Do you use any additional packages in this course?
How would you rate the overall quality of the primary statistical software package you are using for this course?
In Question 7, you identified a primary statistical software package you used in your course. How comfortable are you in using your primary software package?
Please indicate the most appropriate response to the following statements: • I can usually deal with most difficulties I encounter when using my primary statistical software package. • My primary statistical software package makes me much more productive. • I often have difficulties when trying to learn how to use a new statistical software package. • My primary statistical software package is easy to use. • I find it difficult to get my primary statistical software package to do what I want it to. • At times I find using my primary statistical software package very confusing. • I usually find it easy to learn how to use a new statistical software package. • I always seem to have problems when trying to use my primary statistical software package. • My primary statistical software package's syntax baffles me. • My statistical software package is far too complicated for me. • My statistical software package is a good aid to learning. • I consider myself to be a skilled user of my primary statistical software package.
Please indicate the most appropriate response to the following statements. • My primary statistical software package can be applied to practice. • My primary statistical software package can be easily implemented in an agency setting. • My primary statistical software package is affordable for most agencies. • When conducting research, students are likely to utilize my primary statistical software package in the field. • My primary statistical software package will make students much more productive in their agency.

How would you rate your ability to use a computer?
Does your university support R?
Have you ever used the computer programming language R?
Is R difficult to teach to students?
What is desirable about using R to teach your students?*
What is undesirable about using R to teach your students?*
Please indicate the most appropriate response to the following statements. • Most difficulties I encounter when using R, I can usually deal with. • R makes me much more productive. • I often have difficulties when trying to learn how to use a new package in R. • R is easy to use. • I find it difficult to get R to do what I want. • At times I find using R very confusing. • I usually find it easy to learn how to use a new R package. • I always seem to have problems when trying to use R. • R's language/syntax baffles me. • R is far too complicated for me. • R is a good aid to learning. • I consider myself to be a skilled user of R. • R is desirable because it is free and readily available. • R is desirable because there is a large user community. • It is easy to get help when using R.
Please indicate the most appropriate response to the following statements. • R can be applied to practice. • R can be easily implemented in an agency setting. • R is affordable for most agencies because it is free. • When conducting research, students are more likely to use R in the field because it is free. • R will make students much more productive in their agencies.
Is your primary statistical software package difficult to teach to students?
Are you a full-time instructor?
What is desirable about using your primary statistical software package to teach your students?*
What is undesirable about using your primary statistical software package to teach your students?*
Have you ever heard of R?
Please indicate the most appropriate response to the following statements. • R has a steep learning curve. • The R language/syntax is too difficult for students to learn. • R is easy to use. • It's difficult to get R to do what I want it to. • R can be very confusing. • R's language/syntax baffles me. • R is a good aid to learning. • R is desirable because it is free and readily available. • R is desirable because there is a large user community. • It is easy to get help when using R. • Other packages are easier to use than R.

What is the main reason(s) you do not use R?*
What is the main reason(s) you do use R?*
What is your age in years?
What is your gender?
What is your highest social work education?
Approximately how many students are enrolled across all of the social work programs at your school?
In what state is your school, college, or university located?
What is your rank at the school, college, or university in which you are teaching?
In what state or U.S. territory do you currently work?

* - Open ended questions

Measures

Within the sample, 95.3% of respondents identified as having taught or were currently teaching a research course (n=106), while 85.4% identify using a statistical software as a part of that course (n=103). Variables included concepts related to the perception of the use of *R*, including ease and comfort of use for the instructor, their own personal attitudes towards learning new statistical packages, their overall comfort with technology, and attitudes towards using and introducing *R* as a learning tool for students.

Analysis and Results

Descriptive analysis was conducted using STATA 17 (Stata Corp, 2021). Instructors were also asked several open-ended questions connected to their perception of the *R* platform, which was coded for themes using Atlas.ti 23 (Version 22.0.6.0).

Quantitative Analysis

Nearly all participants (96.38 %) identified themselves as having either "good" or "very good" ability to use a computer. When asked what software package was primarily used in research courses, participants' responses (n=99) included SPSS (n=51; 51.5%), SAS (n=1; 1%;), Excel (n=29; 29.3%), Stata (n=1; 1%), *R* language (n=3; 3%), Other (n=2; 2%;, and none (n=12; 12.1%). When prompted, participants who responded with "other" specified the use of Atlas.ti (n=1; 1%) and PSPP (n=1; 1%).

In response to the question "Have you ever used the computer programming language *R*?" 28.9% of respondents (n=24) answered yes, while the majority answered either no (n=45; 54.2%) or that they did not know what *R* was (n=14; 16.9%). The majority of instructors who had used *R* either agreed or strongly agreed that desirability of using the program included that it is free to install and use (n=17; 88.2%), that it has a large user community (n=12; 70.6%), that it can be applied to practice (n=12; 70.6%) and that it can easily be implemented in an agency setting (n=10; 58.8%). Additionally, of instructors who had used *R,* 55.6% disagreed with the statement "*R*'s language/syntax baffles me" though it should be noted that the total respondents to the question was 18.

Qualitative Analysis

A thematic analysis was conducted with regards to the open-ended questions "What is undesirable about using *R* to teach your students?" (n=19) and "What is the main reason(s) you do not use *R*?" (n=34). Researchers utilized a grounded theory approach to understanding perceived barriers through short answers from respondents, using first-level opening coding for all responses then proceeding to axial coding to collapse and create categories, as recommended by Creswell & Poth (2018). After a theory has emerged, the findings will be compared with the previously described lens of faculty barriers. Network models of two emerging themes, "Complexity of Use" and "Unfamiliarity" were created to investigate potential relationships. Results are discussed below.

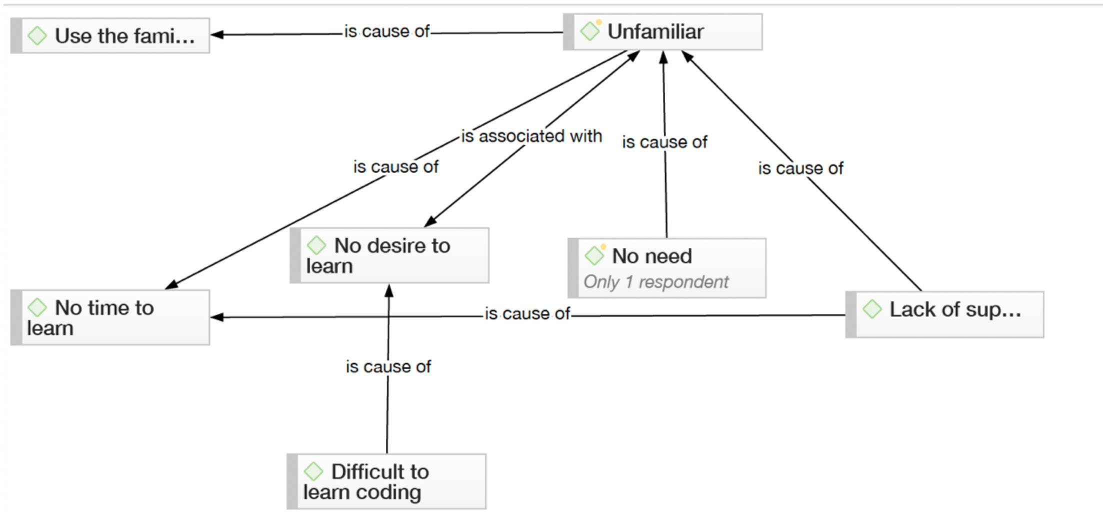

Figure 1. Network model of "Unfamiliarity".

Unfamiliarity

The concept of unfamiliarity with the software were mentioned throughout responses, with many respondents stating some variation of "I don't know it" (n=7), "I'm not trained" (n=4), or "not familiar" (n=3). The network model above explores possible connections to the concept of being unfamiliar with the software. Unfamiliarity is consistent with using any new software; however, there were several specific suggestions throughout the responses for specific causes. Responders mentioned a lack of time to learn new software (n=4), and a lack of support in learning or implementation (n=7); two were quoted as responding "I don't know it and have no support." Three respondents stated that they had no desire to learn a new software, while some that the lack of desire to learn was linked to perception of difficulty in learning the syntax used in *R*. This perception of difficulty in learning syntax will be discussed further in the following section.

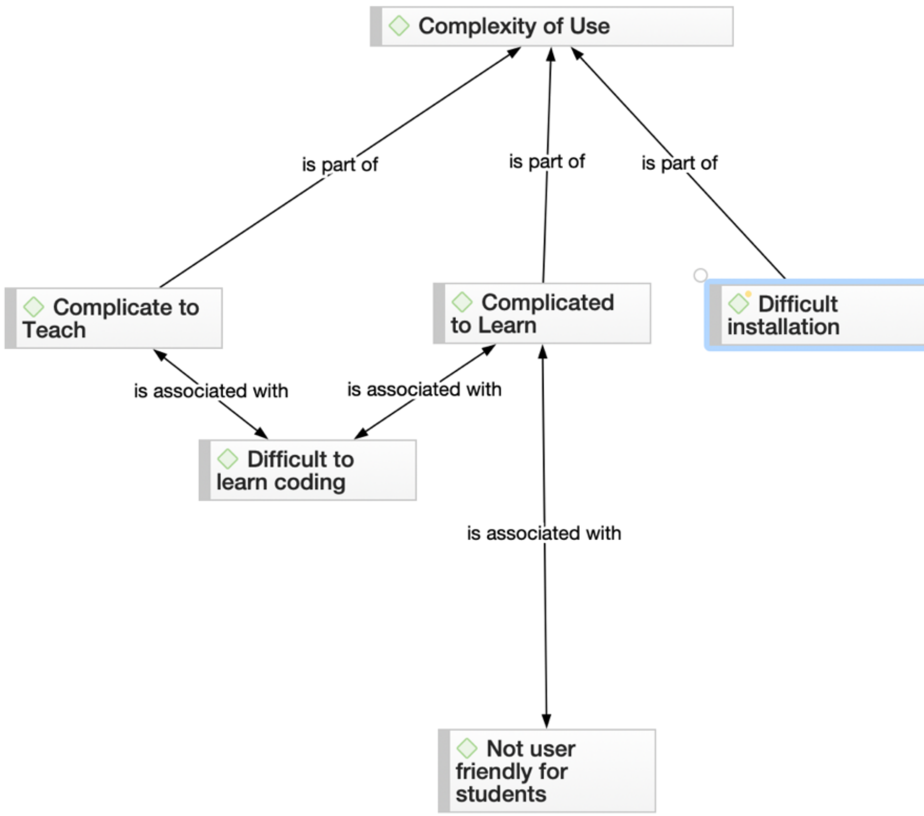

Figure 2. Network model of "Complexity of Use".

Complexity of Use

The theme of perceived complexity was common throughout responses, though the complexity appeared to fall into two main categories: Complicated to Teach and Complicated to Learn. One respondent noted "Difficult installation" in response to the question "What is undesirable about using *R* to teach your students?" but noted that "the instructor must know about installation quirks across platforms." This could be considered related to unfamiliarity.

The perception of difficult syntax, also referred to coding, appeared for multiple respondents as a deterrent to using *R* (n=10). This appeared for many as both a reason to not teach *R* to students and to not learn *R*. Some respondents expanded this perception further and noted that the program was not user-friendly for students (n=7).

Connection to the Profession

Four respondents connected their decision not to teach *R* to the larger field of social work. Responses included, "It is not practical to use in an agency setting," "Social work agencies don't use *R* as a tool when providing services," and "Not common for many undergraduate students... not popular in agencies." One respondent noted, "Is prohibitive, although there are clear and compelling benefits to teaching students something they will continue to have access to long term."

Discussion

This paper does not attempt to argue that professors are not utilizing technology to teach research methodology. As noted in the demographics of the sample, professors are using many types of statistical analysis software in their curriculum, including SPSS. However, the researchers feel the need to investigate the barriers that prevent adoption of a more relevant, newer software that meets the needs and demands of the profession and the social justice challenges of the field, in this case social work.

In building a theory connected to not using *R*, several important connections can be made. The unfamiliarity noted by the respondents in some ways feels vague, and interviews may bring even more clarity to the responses; however, a common premise in understanding unfamiliarity from the provided short reactions include a lack of time and lack of support. Both perceived lack of time and support, as discussed in earlier sections, are well researched and documented barriers to implementation of new technology. Mercarder & Gairin (2020) proposed that without a unified, institution-wide vision of technology, implementation and expectation falls to and is dictated by the individual professor. The responses indicate a lack of institutional support and perhaps a desire to retreat to the comfortable and familiar on the individual level. Failure to be challenged to investigate new technology or allotted the time to do so represents lost opportunities at the institutional level that, if met, has the potential to move the field forward.

In understanding the theme of perceived complexity, it may be that much of the perception stems from unfamiliarity, but it may depend on the facet of complexity. Again, perceptions of technology and resistance to implementation have been documented through prior research, but perceived complexity in this situation is vague in that it is unclear from the responses from where the perception derives. Those respondents that did provide details noted a perceived learning curve or a syntax issue. There are multiple articles that center on how to teach *R* (Fox & Anderson, 2005; Potter et al, 2016; Zeitlin & Auerbach, 2015) and a trove of videos, books and live trainings centered on skill acquisition and practice, and it is unclear as to whether *R* presents more learning challenges compared with learning and attempting to master other software packages, or while simultaneously learning more software packages and advanced math concepts such as is demanded in research courses.

R syntax should be addressed as a potential barrier to use that is unique to this software package, although as mentioned above, it can be connected to perceived complexity. While *R* may, on the surface, be distinguishable from other statistical analysis programs in being syntax-based, it is far from the only program that utilizes syntax: Excel requires syntax for complex formulas, and Stata and MPlus utilize some syntax. Importantly, there are multiple *R* Graphical User Interfaces (GUIs) that harness the power of *R* while providing the familiarity of menus to substitute for some syntax. GUIs such as Posit (formerly RStudio), JASP, BlueSky and RCommander all employ the *R* programming language to provide users a more comfortable experience with less syntax if desired.

Conclusion

Barriers to using technology in academia have been researched, but the above exploration presents the added caveat of adopting new software with an understanding of the implications for the larger profession. By adopting technology that meets the demands of anti-oppressive evidence-based research, schools of social work have the opportunity to take a proactive approach to preparing social workers for the future. *R* is a software package with a power that has been recognized across a multitude of social sciences, but its free cost is an added benefit for a field designed to meet the demands of the most vulnerable and in which resources are already scarce.

There is an immediate need to adapt seamlessly to technological shifts in research and the larger social work field. The perceptions of faculty members towards these shifts serve to either facilitate or hinder this skill for new social workers, ultimately perpetuating a resistance to further innovation. A missing entry point into introducing new technology may be at the doctoral level, in which the institution has an opportunity to not only introduce new technology but to normalize the constant investigation and critical analysis of technology by upcoming new faculty members entering the field.

R, and technology in general, may be adapted more readily in situations where the outcome can be clearly seen. The benefits of *R* for practice evaluation and accountability may not be immediate; therefore, education about outcomes and research to determine these outcomes may be beneficial in implementing a technology that has been adopted by and may be becoming the standard in other social sciences.

Areas for future research may be, as previously mentioned, interviews with professors to provide more depth to their short responses. While possible relationships were presented above, the themes provided could become more concreteness through a longer exploration. Additionally, a longer examination of factors that encourage faculty to use *R*, as well as explorations at the administrative level would be valuable; future research may identify opportunities to change negative perceptions by faculty through discussion and training.

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