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The information literacy needs and practices of research students in the digital age

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Abstract

The nature of tertiary learning has changed significantly over the past decade, in part as a result of the now widespread use of information and communication technology. Given the role of library and information professionals in assisting students through information literacy programs, there is a need for research focussing on student understandings and practices in obtaining, managing and using information. The effectiveness of information literacy programs will be enhanced by consideration of students' information seeking and management practices, taking into account their preferences and problems. While there have been several significant studies involving tertiary students, a better understanding of the specific information literacy needs and behaviours of research students is required.

The study reported in this paper focuses on the following key questions: In what ways are today's research students required to be information literate in their study? What strategies do students develop in order to meet such requirements? These questions were investigated using an interpretivist/ constructivist framework, with the researchers therefore interested in the different interpretations which individual research students would bring to information literacy questions. A purposive sample of research students from one university faculty (Faculty of Information Technology at Monash University)¹ was selected to ensure relative homogeneity for key characteristics. Interview techniques were used to elicit rich-picture, in-depth perspectives. Analysis was influenced by the constructivist grounded theory approach.

Common themes identified in the students' accounts concerned selection of research topics, use and appropriateness of various sources of information (print, people and electronic), online search strategies including the selection of tools such as search engines and particular online resources, the impact of the online environment on research practice, how students decide when enough information has been gathered, how reliability and authority of information are determined, the organisation and assimilation of information, and students' perceptions of the physical versus the online library.

The conclusion will discuss the implications of the findings for information professionals working in the tertiary sector.

Introduction

While there is no doubt about the perceived importance of information literacy, at least within the library and information science literature (Radomski 1999; Shapiro & Hughes 1996), there are different views about how it should be defined and studied. For example, Bawden (2001) has documented a variety of uses of the term 'information literacy'. For Young and Harmony (1999, p.1) information literacy is 'the ability to access, evaluate, and apply information effectively to situations requiring decision making, problem solving, or the acquisition of knowledge'. Bruce (1997a, p.180) on the other hand, in a study of the meaning of information literacy for Australian higher educators, questioned whether users and

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professionals share common meanings of the concept and whether 'skills' or 'attributes' are the most helpful way of describing information literacy. In her view, the concept is better understood in terms of the quite different ways of *working with* information across a variety of contexts, all of which 'students need to be enabled to experience' (Bruce 1997b, np). In a related publication, (Bruce 1997a, p.157) she noted that further research is needed in order to understand tertiary students' experience of information literacy.

Undoubtedly the advent of the 'electronic' or 'digital' age has entailed significant changes to the nature of tertiary learning over the past decade (McCann et al.1998), bringing new dimensions to the concept of 'information literacy' in its wake. This has resulted in library and information professionals giving greater emphasis to the meaning of information literacy, and its place within the learning process, as demonstrated in the Australian and New Zealand Information Literacy Framework (Bundy 2004). Not only is there a heightened need for critical approaches to online information retrieval, given the questionable authority of much information on the web (Devlin 1997; Kellner 1998; Lee 1999; Singh 2001) but, as Luke (2000, p.73) has argued: 'In the digital information environment, an understanding of the relations among ideas is as important as, if not more important than, mastery of the ideas themselves'. Nevertheless, it is crucial that student understanding and use of more traditional learning resources is not overlooked in the emphasis now being given to electronic sources of information, given the wealth of materials that remain accessible in non-electronic documentary forms. In a similar fashion, much of the debate over digital literacy – for example, Gilster's (1997) notion of 'knowledge assembly' – is equally relevant to the critical deployment of other source materials long held in university libraries.

In terms of the information literacy needs and practices of tertiary students in the electronic age, there have been a number of studies undertaken. For example, Tenopir with Hitchcock and Pillow (2003) reviewed a range of studies about use and users of electronic library resources, many of which focused at least partly on tertiary students of different kinds and at various stages of their studies. These are broad-brush studies which provide useful findings but do not focus on students with specific needs. There have been a few recent studies targeting research students in relation to information literacy, e.g., a Finnish survey of 305 students who were writing Masters' theses, undertaken by Heinström (2002), and an Australian study of PhD research by Macauley (2001).

We decided that a further study could be well justified, particularly given the large number of international students at Monash University where the study was to be carried out. There is also a case for undertaking local studies to assist information professionals to understand the needs of the particular students with whom they are working. For example, Monash has numbers of students from countries where formal course-related information provision to undergraduates is mainly textbook-based, and there is little access to proprietary online information resources. These students may have different understandings and awareness of information literacy. We chose research students from the Faculty of Information Technology, believing that, while these students are likely to be highly computer literate and skilled Internet users, they may not all have been exposed to effective methods of finding and evaluating information. In relation to research students in the Faculty, the following questions are relevant to this paper:

- What are research students' information needs?
- What is their understanding of the scope and appropriateness of a variety of information sources?
- What search strategies and tools do they use?
- What are their views of the convenience and currency of access provided by electronic media?
- How do they evaluate information sources in relation to reliability and authority?
- What are their personal information management tools and strategies?

From this point, the paper proceeds to discuss the relevant literature focusing on research students and information literacy, the project's philosophy and method, the findings of the study and the conclusion.

Research students and information literacy

The institutional setting within which research education in Australia is cast is presently in the process of mutation. The Federal government is seeking to establish a mode of regulation modelled in part upon Britain's Research Assessment Exercise system, while using thesis completion rates as a key yardstick for future funding to universities. And yet, whatever the disciplinary nature of such mechanisms, there are other reasons why research students and their supervisors need to consider the question of information literacy with some care. As Houghton and associates (2004) have indicated in a survey of senior Australian researchers' views on the growth of the digital environment,

A new mode of knowledge production is emerging. There is increasing diversity in the location of research activities; increasing focus on interdisciplinary, multidisciplinary and transdisciplinary research; increasing focus on problems, rather than techniques; greater emphasis on collaborative work and communication; and greater emphasis on more diverse and informal modes of communication.

Since our study was completed, the Monash University Library has also reflected further upon its research support role within the broader university's development of research infrastructure. The Library is developing a Research Support Plan which includes consideration of research students' information literacy development needs.

How has research on information literacy and research students unfolded to this point? Believing that postgraduates might require assistance to meet their specialised information literacy needs even when their undergraduate needs had been comprehensively addressed, Bruce (1990) surveyed postgraduate students and their supervisors in an Australian institution. She noted that minority groups, including international graduate students unfamiliar with local information resources and services, or people returning after a long break from study might experience particular difficulties (p.227). Another early Australian study of the information needs of postgraduate students (Hazard, Hegarty & Baird, 1994) confirmed that postgraduates had specific needs for assistance in learning how to effectively store and retrieve information. In a more recent Swedish study of computer science students during a course intended to improve their information literacy, Pilerot (2004) observed that 'PhD students have specific needs which need to be fulfilled to enable them to manage their personal research information satisfactorily' (p. 92).

Macauley's report of his Australian study (2000) of doctoral students and supervisors addressed information literacy skills, scholarly communication, the supervisory process and the relationship of the library in doctoral research. He found acknowledgement of the importance of information literacy in doctoral research, especially with improved access to information. Nevertheless he observed that 'osmosis appears to be an integral part of postgraduate pedagogy' (p.220), as supervisors often assume that their students already have the required level of information literacy, and supervisors' own information literacy proficiencies vary. Suggested remedies included demonstration of prerequisite information literacy skills in postgraduate student selection procedures, formal accreditation of supervisors and reintermediation of librarians into the teaching and learning support role.

In another Australian study of ten humanities students at different stages of their research, Genoni and Partridge (2000, p.234) identified the ability to 'conceptualise their research data in a way which maximises the advantages of the [bibliographic management] software' as a

key postgraduate skill in addition to retrieval of information and effective management of information. They found a range of information literacy extending from 'naïve to reasonably sophisticated', apparently related to time in workforce rather than academic training (p.225) and recommended that information literacy education of both students and supervisors was needed.

Research philosophy and method

For this study, the researchers adopted an interpretivist/constructivist approach in an attempt to understand the information literacy needs of research students, as well as the values, beliefs and the 'meanings' they construct around the issues of information needs, information seeking, and knowledge integration. Both social constructs or shared meanings (Berger & Luckmann 1967), and personal constructs or individual meanings (Kelly 1955) were of interest in the research. In terms of social constructs, we took the view that, when people share the experience of being a university research student, it is likely that some shared meanings will emerge about the extent of information literacy required for higher degree studies, as well as the strategies useful for achieving it. Findings could be useful for library staff and higher degree supervisors, as well as the students themselves. We therefore set out to discover the meanings that were shared by participants, as well as those that were not (consensus and dissonance). Above all, we were attracted to the constructivist paradigm because it enables rich-picture, in-depth perspectives to be elicited from the small sample to which we were restricted for this particular study.

Of the four team members, all had worked on previous, externally funded projects concerning the information needs of a range of social groupings. One currently worked as an Information Literacy librarian at Monash University, while another had extensive experience working and teaching in the library studies area. Two team members also had considerable experience in supervising research students working at the honours, masters and doctoral level.

The study was undertaken with the approval of, and in compliance with, the procedures deemed appropriate by the Monash University Standing Committee on Ethics in Research Involving Humans.

The sample

The 15 students were purposively selected using a limited form of theoretical sampling which did not extend, due to time constraints, to returning to the field to fill conceptual gaps and holes (Charmaz 2003, p. 265). Glaser and Strauss (1967) first introduced the concept of theoretical sampling where participants representing the major categories of people relevant to the research are selected. There is no compunction to sample multiple cases which do not '...extend or modify emerging theory' (Henwood & Pidgeon, 1993, p.25). In our case, the major category was 'students undertaking a research degree', with type of degree and place of study for undergraduate degrees (Monash University or elsewhere) being considered as sub-categories, and gender and age being of some, though limited, importance. We decided to include only research students from one faculty (Faculty of Information Technology at Monash University) so that the sample was relatively homogeneous for other key dimensions. It would have been interesting to have selected students with diverse backgrounds but, because we could only use a small sample, we felt that points of consensus on key issues would be difficult to obtain if we were comparing (for example) students from different faculties.

The participants were recruited through lecturers making the project known to their students. It included three honours, two research Masters and ten PhD students of whom nine were female and six male. Six were aged in their 20s, seven were in their 30s, 40s, or 50s, and two

were aged 60+. Nine students gained their undergraduate degrees from Australian universities. Of these students, four studied at Monash. Six students gained their undergraduate degrees from non-Australian universities.

Data collection

An ethnographic technique, the interview, was used for the data collection. The initial step was to develop a semi-structured interview schedule with significant input from the Monash University Library perspective through our Library team member. All four team members were then involved in piloting the schedule with three research students typical of those we would later include in the sample. We were not happy with this first effort, believing that we would not collect the data we wanted with this instrument. We therefore 'went back to the drawing board' and developed significantly different questions, influenced as they were by the pilot interviews which had given us a very useful introduction to student viewpoints. This interview schedule was then piloted in the way we had done with the first schedule. After some relatively minor modifications, we were happy with the instrument.

The final interview schedule included eleven questions, some with prompts so that data were not missed if particular points were not spontaneously mentioned by interviewees. Because researchers using an interpretivist approach 'seek to be totally open to the setting and subjects of their study' (Gorman & Clayton 1997, p.38), they may adjust research questions to accommodate new perspectives which arise during their data collection, especially early in the process. In our case, a few prompts were added as the interviewing proceeded; the basic questions were unchanged. The questions ranged across topics such as selection, defining and redefining the research topic; sources of information; knowing when sufficient information has been collected; the use of, and getting help with, online resources; determining the authority of online resources; organisation and assimilation of information; the role of previous study and experience; and the ways in which information seeking could be improved, including the role that the library might play.

Individual interviews were undertaken with 15 students from September to December 2003. All four team members, in different combinations of two, took turns in doing the interviews which lasted about one hour. With the permission of the participants, the interviews were audiotaped.

Data analysis

The audiotapes of the interviews were transcribed by an experienced transcription typist. Although the analysis that was undertaken does not constitute a 'grounded theory', it was influenced by the 'constructivist grounded theory' approach of Charmaz (2003) which 'recognises that the viewer creates the data and ensuing analysis through interaction with the viewed' and therefore the data do not provide a window on an objective reality (p.273). While there is every effort made to look at 'how 'variables' are grounded – given meaning and played out in subjects' lives' (Dawson & Prus 1995; Prus 1996, as cited by Charmaz 2003, p.272), there is acceptance that 'we shape the data collection and redirect our analysis as new issues emerge' (Charmaz 2003, p. 271).

All four researchers were involved in the analysis of the data, initially independently. They made margin notes on their individual transcripts, highlighting words which they thought would be potential themes or categories within themes. At this point they compared their analyses and found there was almost total agreement about the main themes. Those relevant to this paper are: selection of research topics; use and appropriateness of sources of information; online search strategies including the selection of tools such as search engines and particular online resources; the impact of the online environment on research practice;

knowing when to stop collecting information; determination of reliability and authority of information; the organisation and assimilation of information; and students' perceptions of the physical versus the online library.

Findings

Participants were asked about various aspects of their study and research, from the initial definition of a research topic to the seeking of relevant sources, their organization and use. We also enquired about previous study and experience, the role of students' present supervisors in their information use and management, and the ways in which information seeking could be improved, including the role that the library might play. For the purposes of this paper, we will concentrate on two aspects of the findings – information seeking and personal information management – before turning to what the interviewed students themselves suggested could be improved on their behalf. We allocated letters as pseudonyms to participants, and these appear in brackets next to their quotes, which are distinguished from other text by italics.

Selection of research topics

Macauley (2001) makes the important observation that research cultures vary across the disciplines found within universities, and that these variations can have important repercussions for how research students undertake their work. A higher degree involving laboratory-based research, for example, may well be an articulation of some broader, pre-existing project, and involve close work with postdoctoral staff no less than supervisors – something very different from the often one-on-one relationship with supervisors that might be encountered by many research students in the humanities. Beyond this Macauley (2001, p.25) pointed out that styles of communication as well as rates and types of publication differ between the Sciences and Arts.

While we chose one faculty in pursuit of relative homogeneity, our fieldwork brought home the varieties of research frameworks and methodologies to be found within the Monash Faculty of Information Technology. As the amalgam of teaching and research clusters first inculcated in a range of other faculties (from Business and Economics to Science and Arts), the Faculty incorporates a variety of research cultures that straddles this divide. Furthermore, while some schools within the Faculty require students (particularly at the postgraduate level) to specify in some detail the contours of their planned research when first making application to study, in others such details are expected to emerge in the initial months of candidature. Not surprisingly, then, the students interviewed in this study had a range of experiences to recount. If the research topics for Honours these were typically determined by supervisors, some Masters' topics emerged from student interest, while others evolved from departmental research projects tied to external grant money. As for PhD topics, these were more commonly chosen for fit with students' past experience or present interests. Several students mentioned changing direction on this front, and in one case the topic had been totally changed, due to lack of relevant data.

Selection of sources

More research students are studying than ever before, more scholarly books and journals are in circulation than ever before. Combined with the continued process of specialisation within academic disciplines, these developments only exacerbate the challenges in identifying relevant sources. If anything, such challenges have in turn been heightened by the extraordinary expansion of electronic-based source material that has become available in the past decade or so – a process closely associated with the emergence of the World Wide Web,

even if it cannot be reduced to the latter. A recent study at Columbia University, for example, reported that 'Undergraduate students are more likely than graduate students to use non-library sponsored web resources, while graduate students are more likely to use library sponsored electronic *and* print resources' (EPIC 2003).

For many of our participants, the question of what kind of source to use in their research was less one of media form (digital or non-digital) than the nature of the documentary formats predominant within their disciplines. For example, H's main reservoir for source material was drawn from journals '*because of currency*'. On the other hand – an indicator once again of some of the disciplinary differences to be found in a faculty such as this – B reported that '*I do look at journal articles but I find that information that I need ... generally comes from books, and I don't get that kind of technical information as such from journal articles.*'

One Honours student informed us without apparent irony that '*It's great having the Internet because you can find almost anything*' (J). While such an observation could be put down to limited experience in information seeking for research purposes – a limitation that the participant freely admitted – it may make more sense when placed within the context of the kind of 'deliverable' required for her thesis, which in this case centred around the construction of a piece of software. More worrying was the statement made later in the interview with the same participant that: '*Most of my research has come from people who work at universities or who are lecturers or have some sort of tertiary qualification. So because of that I don't really question the reliability of the source.*'

We will return to this question of authority below.

Personal sources of information

In relation to interpersonal or informal sources, some recent studies indicate that these are crucial to all types of information seekers and topics. Mills (2003) discusses how university academics access personal sources for teaching and research information, while Heinström's (2002) survey of Finnish Masters thesis students found considerable use of informal information sources. In the latter study, teachers and supervisors followed books and journals as the most used sources of information, while fellow students were relied upon by nearly 40% of the sample, and friends by one quarter. Indeed, some students mentioned people as their most *precious* information sources.

Amongst almost all those interviewed in our study, supervisors were highly valued, much more so than other sources of information mentioned. K's comment that '*I had a lot of support from my supervisor*' was typical in this regard, while H added: '*[My two supervisors] ... never agreed on anything at our meetings. It was not political; they know each other. So I found the disagreement good most of the time. But sometimes it could be confusing.*' Another doctoral candidate recounted that his supervisors had likewise helped in narrowing the scope of his investigation to something manageable: '*I now realise that I've probably got too much and there's enough material there for a couple of PhDs. I only want one*' (C).

In contrast, there was little use registered of online communities. If both library staff and fellow students were cited as sometimes helpful sources of study-related information, a number of participants stressed the isolation that stemmed from the specialised nature of their research topic.

Search tools – and authority of sources they uncover

In seeking relevant sources for their research, to which information-seeking tools did participants turn? A recent study (OCLC 2002) found that search engines such as Google

were popular tools for study-related information seeking amongst the broad population of US tertiary students sampled. The research students we interviewed similarly identified Google as a first or second choice as a search tool, even when they were aware of (and used) library-sponsored databases and the like. Indeed, given its familiarity, speed, ease of use and a likelihood of relevant 'hits' being returned, Google was for many of our participants the yardstick against which other search tools were assessed, as comments such as the following attest: *'I do like Google. Even when I search [Monash University] stuff I use Google. Google is fast.'* (M)

But what about the authority of sources found in this way? While interviewees often expressed a certain wariness of materials found on the net, a number were confident enough of their own grasp of the relevant literature to be discerning. According to one PhD student, *'I know how easy it is to put stuff on the Web ... If it doesn't have that ostensible credibility, then I'm not going to use it.'* (D) All the same, at least one doctoral candidate offered the following thoughts in response to questioning about the reliability or authority of information found online: *'I don't think of that. I always think that what I get online is valid.'* (L)

Search strategies

The students interviewed recounted a considerable variety of established search strategies. Even here, Google was never too far away, with at least one student telling us that *'Mostly when I need something I just go to Google and type in keywords...'* (L). Even better, according to O: *'The good thing about the Internet is that ... the more you use [it], the more it will be helpful for you and the more you understand it. It is a cumulative effect and it accelerates your searching capabilities. It tells you the searching techniques automatically.'*

This was admittedly an extreme view. A's experience, by contrast, was very different, and her stance considerably more sceptical:

It depends on which search engine you use, whether you click on the next link ... If you find something once it is hard to find it again because of the amount of information out there. You search on Google for instance and you come back with 10,000 hits. You never make it to the fifteenth page of links. You give up.

On the other hand, most research students interviewed looked beyond the Internet to more specialised academic resources. Some sought to familiarise themselves with the controlled vocabulary in particular databases, while others followed up references found in the bibliographies of source materials, such as theses or journal articles. A, for instance, told us that she *'tend[s] to start in a database, and search on keywords'*, bearing in mind that *'each one has its own set of keywords'*. B instead took a more traditional tack, based on the examination of bound journals: *'I look at the volumes searching literally through each volume seeing if any of the articles will interest me.'*

Impact of online environment on research practice

In their overview of recent studies concerning the use of electronic materials in tertiary education, Tenopir with Hitchcock and Pillow (2003, p.5) note that: *'Convenience remains the single most important factor for information use – all types of users prefer electronic journals only if they make their work easier and give them the information they need. Desktop access, speed of access, and the ability to download, print, and send articles are top advantages of electronic journals for all groups.'*

For many of our respondents too, convenience of access and currency of information lent great appeal to online source materials. For example, according to E (a Masters student with

parental responsibilities): *'the online library databases are probably the most important thing because they give me access to resources that I couldn't physically get to otherwise'*. Just as important for some students was access to the latest contributions in their field: *'things that were published five years before or one month before is available online so I can be in touch with the current research in a short period of time'* (O). Even here, however, Google was able to make another appearance, with G telling us that *'It is just easier to go through a general Google search first'*. And for a few respondents at least, the physical effort of entering the library precinct for source materials or to seek assistance with information seeking was often too much to contemplate, even when their study space was housed nearby:

You have to move from this building and to another building and it is a hassle to walk down to the library and get the journals, it was much better to get it printed [out from downloads] upstairs ... I like online help because of the inconvenience of walking down to the library because I don't like walking down two storeys. (L)

Knowing when to stop gathering information

Researchers, whether seasoned or novice, often have real difficulties in determining if they have accrued sufficient relevant information. Here too, as in so much of what we have discussed, disciplines, topic domains, methodologies, source types and scope can all make a big difference. Bringing information 'collection' to an end is often bound up with providing 'focus' to a project (Kuhlthau, 1991) – something that can be more easily said than done in research. As Macauley (2001: 21-3) has noted, the focal point for such searching in postgraduate research is often the construction of an appropriate literature review, but even this task does not exhaust the purpose of all sources relevant to a thesis.

We asked students how they decided when enough information had been gathered in their research work. The most common response was neatly summed up by E: *'I wish I knew'*. Not all felt so intimidated, however. N, who saw his research work as the aggregate of a series of precise subtopics, stated that: *'I just move on'* once a given question was answered. Even here, though, there was a qualification: *'maybe six months down the track I might just happen to come across another paper that is actually relevant too and I might go back and try and incorporate it'*. Others noted pragmatically that the time and scope of their project dictated that information seeking be conducted (and then terminated) at a brisk pace. In this context, G neatly made a connection to personal sources of information: *'that's something you use your supervisor for, to say, "That's enough"'*.

Organising what has been found

As discussed in the literature review, a Curtin University study by Genoni and Partridge (2000, p.233) concluded that 'many students who undertake postgraduate research are poorly prepared for the personal research information management tasks which await them'. Asked to describe the practical measures undertaken in their research, participants in our study related very different systems for storing and managing the materials they had compiled, from EndNote to sticky notes placed upon hard copies of articles. At one end of the spectrum, we encountered a tightly orchestrated approach: *'I print out or photocopy all the articles. I index them. I have a little Access database which I key in the titles and keywords and all the authors and then I can do cross-referencing.'* (E)

At the other extreme, we encountered tales of full-blown improvisation: *'It depends on what kind of mental mood I'm in ... The easiest I find is just keep it all in my head and most of the time I will remember, "Oh I read that somewhere, and it's over there"'* (A). At various points somewhere between these two poles, other students described information management methods that seemed nonetheless to have often been developed in an ad hoc manner, on the

run, and in isolation. Then again, few were as fortunate as the following doctoral candidate, who told us that:

In our department we get that help from a staff member so when we write a paper we can just give that paper to her and she will go through it and make sure we have cited properly and references are done properly. There is also a [departmental] guideline which gives information on how to cite and how to reference. (L)

Conclusion

This study confirms that research students with well developed information technology skills do not always have the necessary expertise and confidence in finding, evaluating and managing information, nor do they always recognise their lack of expertise. Our sample included representatives of several levels of the research student population in one faculty. Few of the students expressed a view that librarians could or should have roles in assisting with development of information literacy. Most appeared to be unaware of the availability of the classes, online tutorials and support pages the library provides, including for EndNote, the bibliographic management package for which the university has a site licence. Generally they also did not seem to know about the team of librarians specifically assigned to support their faculty.

Students who return to study after several years' break or students who have experienced different undergraduate education styles to those at Monash University may not expect librarians to be involved in teaching and learning and indeed may not know that the people who work in the library are not all librarians. It is also likely that there is a perception of a requirement for independence at research level. Supervisors may encourage this attitude and may not be aware of their students' information literacy development needs. Librarians could help to address those needs by fostering closer professional links with academic staff and marketing their own specialised skills to supervisors and research students more effectively. Information professionals should also aim to present the outcomes of their work to seminars of students, academic and library staff, as well as to publish their discipline-specific research findings on information literacy in journals that are likely to be read by supervisors and research students.

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