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Applying a Reverse Induction Process for Improved Definition of Higher Education Technology-Supported Research Projects

Joanne Doyle
Australian Digital Futures Institute
University of Southern Queensland

Helen Farley
Australian Digital Futures Institute
University of Southern Queensland

Scoping out the detail of a Higher Education research project can be a time-consuming and frustrating experience. The excitement of a research project is frequently stifled by the tedious process of mapping out project activities, estimating required resources and developing project schedules.
Reverse induction provides a fresh approach to defining technology-supported research projects. In much the same way as new product development must be guided by an understanding of customer needs, reverse induction focuses on research outcomes before formulating research aims. Using a systematic process of backward reasoning, researchers can define a project concept in a structured and efficient manner. There is significant potential for reverse induction to deliver time and cost savings in a complex and challenging Higher Education environment.

Keywords: project management, technology, learning

Background

Academics are struggling to manage existing workloads, and almost 30% of academics have either a long-term or a short-term intention to move to an academic position in another country (Bexley, James & Arkoudis, 2011). One of the reasons contributing to academic job dissatisfaction is insufficient funding for research. Research undertaken at the University of Melbourne indicates that almost half of academics surveyed (49.1%) are not confident that they can get research grants.

Graves, Barnett and Clarke (2011) have estimated that the average amount of time spent on preparing each research application submitted to the National Health and Medical Research Council in 2009 was 22 days, and the average cost of preparing each application was $17,744. Once an application is submitted, the assessment process is costly and subject to a high degree of randomness owing to variation in panel members' assessments. The relatively poor reliability in scoring by panels is to be expected given the complexity of the assessment task and the subjective nature of the assessment process.

In the case of technology-supported research projects, defining a project concept can be particularly challenging:
- Are the project outcomes applicable to one type of technology or a range of different technologies?
- Does the project seek to enhance technology-supported learning outcomes for the student or teacher or both?
- How do you demonstrate the sustainability of project outcomes when the technology itself may be obsolete within a short period of time?

If researchers can minimise the time required to scope out a Higher Education technology-supported research project, they can prepare and submit a greater number of funding applications, increasing their chances of funding success.

Overview of reverse induction

Reverse induction, or backward induction, is the process of reasoning backwards in time to determine a sequence of optimal actions. Backward induction is considered to be a more complex but efficient procedure than a (forward) exploration strategy (Seyed-Allaei, Amati & Shallice, 2010).

Marketing was an early discipline to apply the principles of reverse induction. Marketing focuses on consumer needs as the best route to product development (Kotler, 1972). "Given the customer's needs, the industry develops backwards, first concerning itself with the physical delivery of customer satisfactions" (Levitt, 1960).

Marketing myopia and the 'better mousetrap' fallacy are avoided by identifying consumer needs and developing a product that satisfies those needs.

Reverse induction is also used in game theory to solve finite sequential games. The iterative process starts with determining the optimal strategy of the player who makes the last move of the game. The optimal action of the next-to-last moving player is determined taking the last player's action as given. The process continues backwards until all the players' actions have been determined (Shor, 2005).

Defining Higher Education research projects

Traditional technique of defining research projects

The traditional technique for defining research projects starts with the research aim. The researcher then specifies each activity necessary to achieve the research aim. The research outcomes evolve during the process and with some minor manipulation, the research aim and outcomes can be aligned with funding scheme priorities. If not, the researcher will need to identify an alternative funding scheme, or make further adjustments to the research aim, outcomes, and activities (refer to Figure 1).

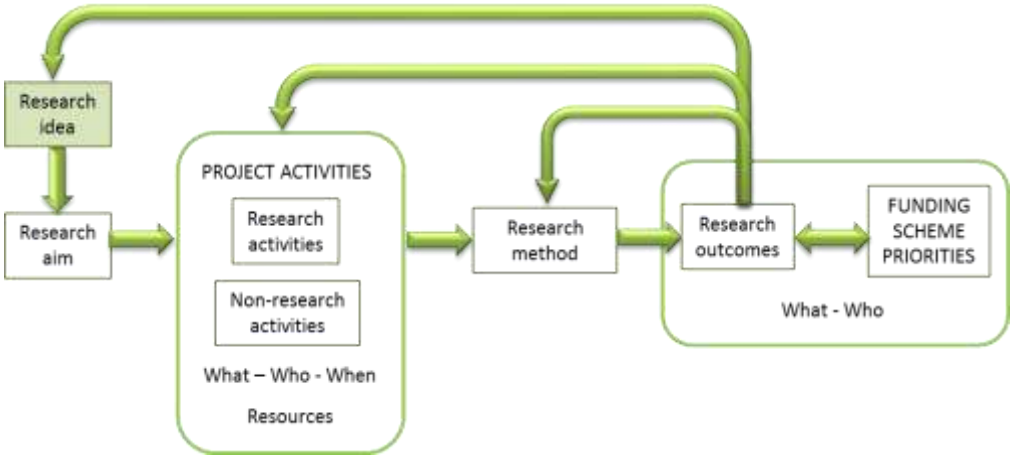

Figure 1: Traditional technique for defining technology-supported research projects

Reverse induction for improved definition of research projects

Reverse induction, as it applies to project definition, is the process of backward reasoning, whereby the optimal process for a technology-supported research project is achieved by starting with the research outcomes. By focusing on the research outcomes, and working backwards to the project aim and objectives, academics will be able to define research projects in a more structured and time-efficient manner (refer to Figure 2).

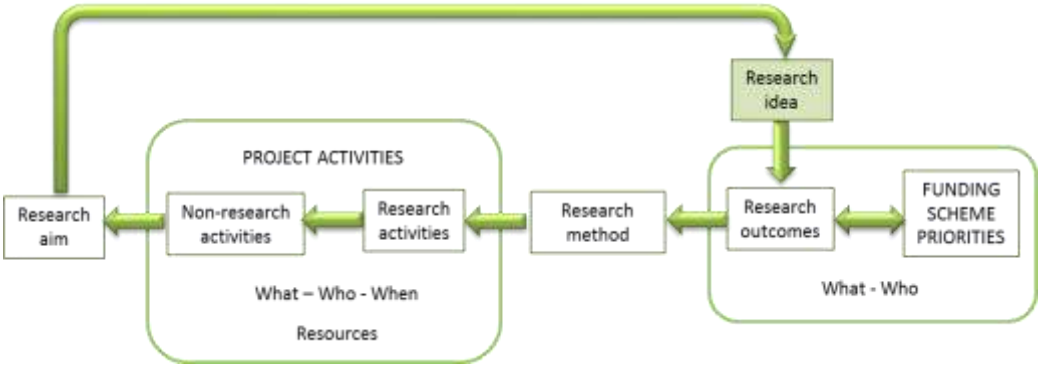

Figure 2: Reverse induction technique for defining technology-supported research projects

At each stage of the reverse induction process, activities are identified as outlined in Table 1.

Table 1: Activities identified at each stage of the reverse induction process

Research idea	Articulate an initial project concept. This should be a broad overview of the research project. It should not be a detailed explanation of the anticipated research aims or outcomes, but an overarching statement of the research intention.
Research outcomes	Detail specific outcomes in terms of what will be developed/produced and who will benefit (the sector, the institution, leaners, teachers, etc). These should be broadly aligned with relevant funding scheme priorities. CHECKPOINT: Do the research outcomes match the funding scheme criteria?
Research method	Provide an explanation of the method that will be used to generate the outcomes – the focus is on the most appropriate choice of research. Options may include action based research, design based research, etc. CHECKPOINT: Is the research method appropriate for the research outcomes?
Research activities	Provide details of the specific research activities that need to be undertaken. Options may include focus groups, surveys, etc. Research activities must be aligned with the research methodology and be able to justify the research outcomes. CHECKPOINT: Are the research activities aligned with the research methodology? CHECKPOINT: Will the research activities enable the research outcomes to be achieved?
Non-research activities	Provide details of all the non-research activities that need to be undertaken to support the research activities – developing the surveys, trialing the surveys, determining method of selecting research participants, arranging focus groups, ethics clearance, etc. Each activity will have resources allocated to it ($, people, place, etc) Identify all other non-research project activities (establishment of legal agreements, purchasing activities, etc) and allocate resources. CHECKPOINT: Are the project activities (research and non-research) sufficient to enable the research project to be undertaken?
Research aims	Review the research methodology and research activities. Develop a research aim based on the research activities, methodology and outcomes. CHECKPOINT: Are the research aims aligned with the research outcomes? If there is any discrepancy, review the research outcomes and adjust them. Check that the funding scheme criteria are still being met.

The cyclical nature of the process enables the initial research idea and research outcomes to be adjusted to align with the emergent research aim.

At all times, the focus is on research – project activities are secondary. The premise of the backward induction technique is that if you can accurately determine the research outcomes, activities and aim, the project will be better defined to reflect the true work required. Superfluous activities are minimized.

Early results

Since early 2012, the reverse induction technique has been trialed at the Australian Digital Futures Institute. The process has proven to be an effective approach for scoping out technology-supported research projects in the areas of electronic publishing, mobile learning and multiple-channel delivery of Higher Education content.

In one particular case, an Early Career Researcher used the reverse induction technique to efficiently isolate the research aim and clarify the research proposal. By following the process, and focusing on research outcomes rather than project activities, the researcher was able to synthesise his initial research idea into a condensed and precise research aim. This was a vast improvement on the vague and overwhelming project concept originally articulated (refer to Figure 3).

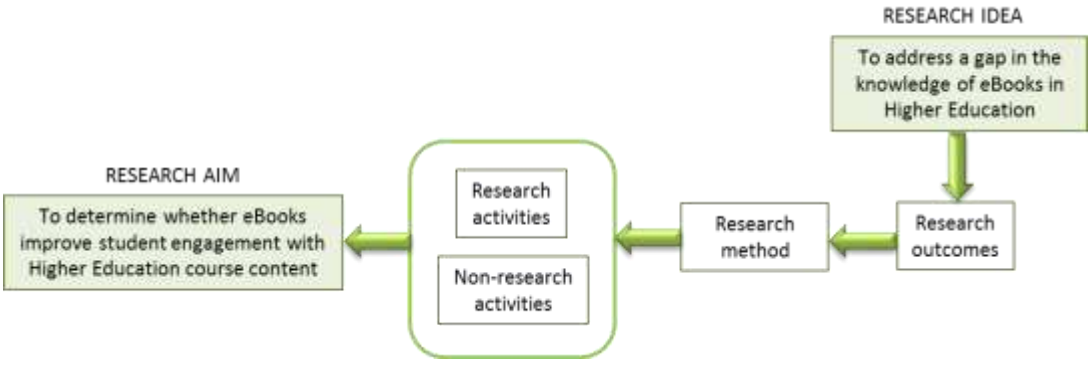

Figure 3: Improved articulation of research aim using reverse induction

Although difficult to quantify savings, it is estimated that the process of mapping out a technology-supported research project using reverse induction achieves a 40% reduction in time over traditional processes for defining projects.

Further trials of the reverse induction technique will continue throughout 2012/2013 to provide a better understanding of comparative time and cost savings against funding success rates.

Conclusion

This paper is about applying a reverse induction technique to define Higher Education technology-supported research projects. Reverse induction is a backwards mapping approach that can be used to streamline the scoping of research projects. The approach uses research outcomes as a starting point which is in contrast to the traditional activity-focused technique of mapping projects. The research activities and research aim evolve during the mapping process, and because they are outcome-focused there is little need to re-work the project scope to match funding opportunities. Early results of this technique are encouraging. The simple yet structured approach is proving to be a time-efficient process for researchers to define technology-supported research projects.

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Author contact details:
Joanne Doyle joanne.doyle@usq.edu.au
Helen Farley helen.farley@usq.edu.au

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