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Independent Study

*Impact of research methodology upon student engagement
and Productivity*

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Aims and Objectives

This assignment is an independent research project which aims to impact upon professional development for those in the education sector. The topic chosen is how research methodology impacts upon engagement and productivity. This title has been selected as beneficial for research students as well as academics working in the Higher Education (HE) sector. The assignment argues that research methodology in term of analysis and selection can in of itself impact upon engagement and productivity, and therefore an academic can improve student (and self) performance by considering these impacts when directing students in their studies within both the social and technical science fields.

In the undertaking of this research the intended aim is: ***'How select methodologies impact on student engagement and motivation within technical and social science disciplines'***

Introduction

The learning process for any given individual is in many respects disparate from the process of another [1], [8]. In accordance with this, so too must the teaching style. Furthermore, the discipline within which the teaching is to occur requires a distinctly compatible approach in terms of both delivery and assessment. The engineering and computation disciplines are no exception to this rule and consequently in many respects require a uniquely designed curriculum for conveyance of concepts.

Within the United Kingdom, the vast majority of higher education degree programmes incorporate an academic progression through a number of years, each building upon the knowledge of preceding study. Final year degree students are typically tasked with the compilation of literature in relation to their chosen topic in form of a research project or dissertation [5].

Many technical subjects, computing being no exception, largely discriminate in favour of the research project. As part of this undertaking, the student is required to undertake a large element of independent study. Such independent study places a larger responsibility upon the student in relation to the other modules that will be studied [7]. This independent study is supplemented by

contact with a supervisor whom will provide guidance and direction to the student.

Independent study is inherent in the process of obtaining knowledge, however, in the context of the research project this can pose several issues. Consequent to the requirement for autonomy and self actualisation, students find themselves in situations whereby they lack both direction and worse, understanding of the topic area they are supposedly studying [6].

Background

The research undertaking by final year students will predominantly include the identification of a topic area for study in addition to elucidation and analysis of a problem within this discipline [9]. Students will be required to produce literature for outlining the chosen discipline in addition to defined problems.

The introductory element of a research project is followed by what is unequivocally the largest literary element of the task; this is typically manifest in a literature review or systematic review. A literature review, is the process of reading relevant textual works for the identification of salient concepts and principles in the area and specific problem domain of the aim of the research [10].

A systematic review is often mistaken for a literature review, with some texts using the terms interchangeably for the accruing of information relating to the research area. A systematic review is in fact different from a literature review by three distinctive characteristics; the scope, the purpose and the depth of knowledge ascertained [11]. The systematic review progresses from the proposition of an initial hypothesis whereas the literature review does not. Following this initial hypothesis, the systematic review seeks to outline the specific literary works that bear the most resemblance to the topics being discussed highlighting those efforts that have formed the base for this given hypothesis [12].

Secondary research is composed of the works of others and, parallel to the existence of the works of others in multiple forms, so too can the way in which this information is accumulated and interpreted. There are a plethora of different approaches to achieving this task, each with their benefits and detriments for a given discipline [13], [14].

Inherent in the process of a systematic review it is expected that the researcher holds a thorough understanding of the topic area and the historical works for the discipline that could impact upon the research being undertaken. This highlights a marked contrast between the this approach and that of a literature review in that the literature review requires greater breadth of knowledge in place of depth [15].

In contrast to the beneficial aspects of the approach there are also a number of prerequisites to the application. The systematic review, requires that the researcher knows the topic area that they

will be exploring in addition to the specificity of the problem [16]. This renders the initial stages difficult because a greater level of knowledge is required prior to commencing the review; thus prior research effort is necessary. It is often difficult to determine what the research question is when asked to conduct original study as a student therefore, interpretation of and synthesis from existing literature is key [17].

Research is a well traversed topic and consequently, many solutions have been explored in the mitigation of some of these detrimental factors. Not least of these are approaches to identification of appropriate literature with respect to the systematic review process. Some of the more widely accepted approaches to this include the use of PRISMA and CASP [18], [19].

The PRISMA approach to conducting a systematic review utilises a framework for the study isolating each of the components within, devolving all sections into their constituent parts. This makes it far easier to determine what is required for each of the sections of the study. In addition, a flowchart is utilised to determine if the literature being viewed is relevant to the work. If the literature is determined to be relevant then this is noted according to the reasons why and likewise if the literature is not included [20]. This approach also applies well to meta-analyses.

Not too dissimilar from the approach described for PRISMA, an approach by the name CASP also reduces the complexity of the literary selection process. CASP is based upon the completion of a number of different generic questions related to the research in determining if the work is relevant or not [19]. This approach provides for an adequate repeatable process for identifying relevant and salient points within the research.

Impact Upon Researcher Engagement

Having discussed the approach taken by PRISMA, it becomes immediately apparent that this has several benefits; not least the separation of the sections. This segregation of not only the sections but also the components within the sections provides absolute clarity with respect to what should be included within each [23]. Furthermore, the inclusion of a flowchart for identification of relevant works, as outlined in , decrease the complexity of the literary selection process.

Though PRISMA decreases the complexity of the selection process, it poses a detrimental impact

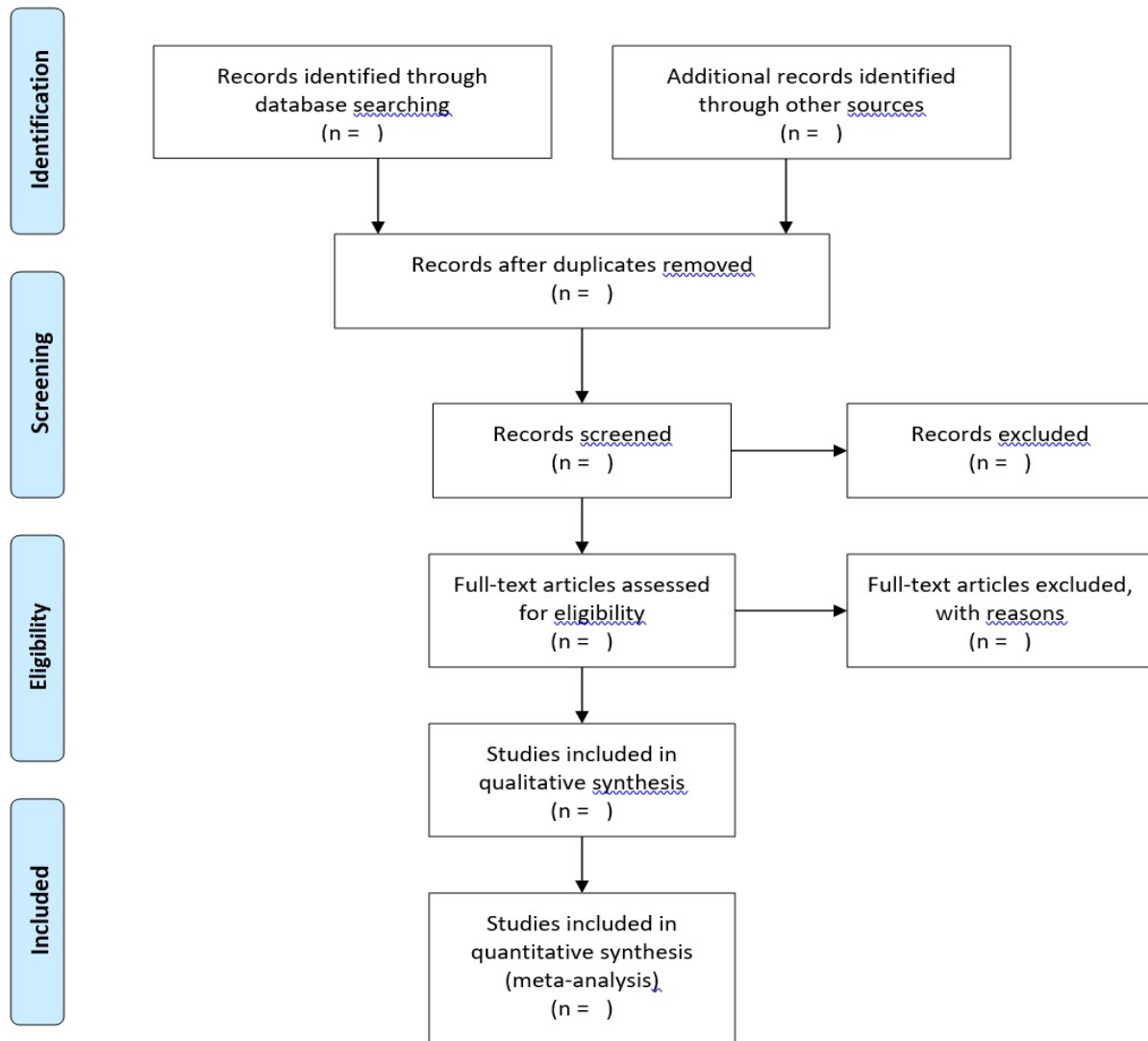


Figure 1: PRISMA Flow-chart [21]

to the time considered for the study. The overheads created by the noting of each of the literature, whether they have been included or not, adds a considerable amount of extra time. This affects the overall time for the research which could lead to decreased motivation within the student [23].

CASP provides many benefits to the research, not only with the selection of appropriate materials but in the attribution of validity of works and the extent to which they hold relevance [24]. There are a number of differing variants to the checklist for this approach, catering for a wide range of disciplines should they follow this approach.

As is the case with the PRISMA approach noted previously, this form of analysis also increases the

Paper for appraisal and reference:

Section A: Are the results valid?

1. Was there a clear statement of the aims of the research?

Yes	☐
Can't Tell	☐
No	☐

- HINT: Consider
- what was the goal of the research
 - why it was thought important
 - its relevance

Comments:

2. Is a qualitative methodology appropriate?

Yes	☐
Can't Tell	☐
No	☐

- HINT: Consider
- If the research seeks to interpret or illuminate the actions and/or subjective experiences of research participants
 - Is qualitative research the right methodology for addressing the research goal

Comments:

Figure 2: CASP Checklist [22]

overheads for the research with respect to time for analysis and noting of works that will not be included. This can further reduce motivation and lead to questions with regard to applicability of the approach.

Impact upon Research Process

The compilation of the necessary literature is an arduous task even for the most accomplished academic but is unfortunately a necessary task. Though seemingly tedious, The literature is both

beneficial and instrumental in the understanding and assimilation of given topics. Though still tasking for accomplished writers, the process is far more apparent than to the uninitiated student. The experienced academic is able to make decisions as to the relevance of literature where a student may be unable to make the same informed choices. This poses issues with students including, in some cases, irrelevant materials to the ideas that they are proposing [25].

In compounding the issue of identification of relevant materials, students also find it difficult to identify the type of research that they are to be undertaking. This can make it increasingly more cumbersome to decide upon an appropriate methodology upon which to base the research [26]. Secondary research is the process of inferring or extrapolating knowledge from the works of others [14]. In the most primitive of terms, the literature review is in itself a manifestation of this concept. Many students within the hard science disciplines consider their research to be of a primary nature with no element of secondary research contained within being contradictory to the actuality of the task.

In cases where secondary research is the only means by which information is accrued, it is difficult to maintain focus and motivation, particularly so with respect to studying topic areas in which the researcher is unsure or has little interest [27]. This issue, is compounded further when undertaken as an independent study element adding a further dimension of uncertainty, leading more fatalistic learners to become disengaged consequently presenting work of lower quality [3], [2], [4].

Fortunately, within technical fields, most students are encouraged to engage within primary research. This requires the researcher to participate in more practical elements after having identified the relevant underlying theory. The inclusion of primary research can increase the engagement and motivation of the student and further understanding of key concepts through the employment of the same [28], [29]. Primary research is the act of producing original results from a pre-determined task as identified by the researcher [14].

Similar to the secondary research, primary research can be conducted in a number of different ways dependent on what the research is trying to achieve. This can manifest in the form of experimentation, observation and surveying to name but a few. Each of these approaches will yield original results which can later be analysed in order to infer knowledge from the study [30].

In most technical subjects, particularly computing, engineering and electronics, it is likely that

a student will commence a research project which incorporates some element of experimentation. Experimentation is an approach to study whereby the researcher first identifies a problem that they wish to investigate, proposes a hypothesis, defines a methodological process through which they will perform their experiment and finally enacts this methodology to produce results [31]. Throughout this process, the researcher requires constant engagement, understanding of the subtleties of the resources that they are using and the ability to resolve issues upon their emergence. This differs from the secondary research aspect noted previously, reducing the risk that a student would become disengaged therefore fostering an environment in which the student is able to produce work of greater quality [32].

Experimentation requires engagement and motivation as an innate component of its undertaking. As such this fosters interest by the student and encourages the student to further understand and observe the changes within the resources that they are using. Further to this, the student has the ability to interact directly with the research that would not be possible with secondary research, incorporating the student as an actor of change [33], [34]. Again, this forces the student to become far more aware of their own impact upon the research and consequently encourages the learner to conduct further study in pursuit of mitigating procedures.

Though this approach provides for a more stimulating learning experience with respect to independent study, there are still flaws within the process. In some cases, the resilience of students can pose issues with respect to the continuation or cessation of a research project dependent on accessibility of resources and expected results [4]. If a student is unable to access the resources and materials that they may need, this could deter them from following this approach. Compounding this are issues with regard to ascertaining expected results. If the student does not retrieve the results that they expect, this could lead to phenomena such as self-disbelief and imposter syndrome without appropriate guidance and or intervention [35].

Observation is almost identical to the approach taken by experimentation in that it produces original results, however, is differentiated by its methodology. This section is defined by another party and in many cases by naturally occurring phenomena. In this approach, a researcher acts as an external observer recording a process as it occurs [36]. This approach is taken in cases where the researcher may impact upon the results if conducted experimentally.

Observations are better suited to those areas of research where the student may wish to record data about naturally occurring phenomena such as solar activity, tidal activity or material wear. This approach is beneficial in these instances as it removes impact of the observer upon the testing.

This approach can negatively impact the researcher because of the length of time taken for observation of given phenomena within the study. This fosters an environment in which the researcher may become less engaged and as such question the original approach in instances where results are not obtained for extended periods of time therefore resulting in stagnation of the project and consistent adjustments [37].

In cases where a field of study requires participation of other individuals, it is preferable to use a method decorated with the name surveying. When a researcher follows this approach to research, they typically construct a carefully articulated collection of questions which will be provisioned to participants and eventually collected containing the responses from the same [38]. Surveys are particularly helpful within the social sciences providing a very effective means of collecting qualitative data.

Surveys can provide a rich collection of qualitative data through which feelings and experiences of others can be inferred. This allows for a researcher to effectively mine distinctive information from otherwise difficult to analyse information [39].

The complex nature and format of the data collected makes it difficult to analyse in absolute attributions. This makes the job of the researcher marginally more taxing and as such can lead the researcher to constantly question abilities and approaches taken in the data collection and analysis efforts [40]. In addition, this approaches extra concerns with respect to the impact of the surveyor upon the participants, requiring that the researcher document the position they hold in relation to the individuals being surveyed adding an extra component of complexity to the approach.

Conclusion

The largest element of any research project is in the amassing of literature. As has been discussed, this can be approached in a number of differing ways each with benefits and detriments with respect to the nature of the research. In amassing this work in addition to later analysis, it is imperative that the student identify an appropriate approach to ensure engagement and motivation throughout the course of study. In the instance that a hypothesis or hypotheses are proposed and a requirement for secondary research is stipulated it has greater benefit to utilise a systematic review approach. The adherence to the systematic review methodology enables the student to follow well-defined methods in which they are able to efficiently and effectively collate relevant literary works. This reduces the stress experienced by the student because of the reduction in confusion as to the relevance of the works. Furthermore, this reduces the requirement for constant supervisor contact reducing the strain on resources.

When undertaking primary research approach it is similarly vital that the student and supervisor cooperate to identify an appropriate means through which the required data may be ascertained. In some cases it is not possible to make use of some of the approaches discussed as a consequence of lack of resources and time. In addition there may be instances where by the tutor does not necessarily hold expertise required for the observation or experimentation. Where a student is to undertake primary research, it is of greater benefit that the student is provisioned appropriate training and guidance from the outset with regard to the magnitude of the task. In being adequately informed of the task requirements and the subject area within which the task is to be performed, the student is far more resilient being able to resolve issues with the work should they occur.

Being the largest body of contiguous work within a research project, the literature review has by far the greatest impact upon resources and consequently motivation and result. It is because of this that it is imperative that the student focus upon the approaches utilised for this element and chooses the most appropriate methods for the collection of the result.

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PRISMA

The PRISMA approach to conducting a systematic review utilises a framework for the study isolating each of the components within, devolving all sections into their constituent parts. This makes it far easier to determine what is required for each of the sections of the study. In addition, a flowchart is utilised to determine if the literature being viewed is relevant to the work. If the literature is determined to be relevant then this is noted according to the reasons why and likewise if the literature is not included. This approach also applies well to meta-analyses.

Systematic Review

The systematic review progresses from the proposition of an initial hypothesis whereas the literature review does not. Following this initial hypothesis, the systematic review seeks to outline the specific literary works that bear the most resemblance to the topics being discussed highlighting those efforts that have formed the base for this given hypothesis.

Literature Review

A literature review, is the process of reading relevant textual works for the identification of salient concepts and principles in the area and specific problem domain of the aim of the research

CASP

CASP is based upon the completion of a number of different generic questions related to the research in determining if the work is relevant or not. This approach provides for an adequate repeatable process for identifying relevant and salient points within the research.

Engagement

The largest element of any research project is in the amassing of literature. As has been discussed, this can be approached in a number of differing ways each with benefits and detriments with respect to the nature of the research. In amassing this work in addition to later analysis, it is imperative that the student identify an appropriate approach to ensure engagement and motivation throughout the course of study.

Being the largest body of contiguous work within a research project, the literature review has by far the greatest impact upon resources and consequently motivation and result. It is because of this that it is imperative that the student focus upon the approaches utilised for this element and chooses the most appropriate methods for the collection of the result.