

## USING DOOYEWEERD'S FIFTEEN MODAL ASPECTS TO DIAGNOSE CHALLENGES IN ACTION RESEARCH

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### Abstract

When an interactive action research process is followed, the first of five phases encompassing problem diagnosis, action planning, action implementation, evaluation of action taken, and the identification of learning outcomes, requires the practitioner to attain a comprehensive understanding of a complex situation. Within the critical social theory paradigm, a diagnosis serves to pinpoint issues requiring attention in the subsequent phases. This aids the progression of the entity being researched by suggesting enhancements to current circumstances that is suboptimal. Given the paramount role of accurate problem diagnosis, particularly with the aim of critical social theory toward participant emancipation, a holistic and sound comprehension of the issue under study is crucial. Limited guidance is provided in terms of how a researcher may structure the diagnosis phase. In an earlier action research study, the five considerations developed by Churchman was used to guide the diagnoses. The approach investigated here, accredited to Dooyeweerd, is also examined within the context of critical social theory, specifically in systems theory—a multidisciplinary exploration of systems. The five Churchman considerations are used to guide the investigation. The aim is to demonstrate the comparative efficacy of the modalities in structuring the diagnostic phase of action research. Dooyeweerd's fifteen model aspects, which address various facets of human experience, are framed as questions for comprehending a system holistically. This approach extends beyond mere insight, striving to unveil power structures.

### Keywords

Critical Social Theory, Systems Thinking, Action Research, suite of fifteen Dooyeweerdian modal aspects, five Churchman considerations

### 1 | Introduction

In this study the value of Dooyeweerd's fifteen modal aspects, compared to Churchman's five considerations – in diagnosing a single application cycle within a series of cycles – is investigated. An action research study in an educational setting, made use of the five considerations developed by Churchman to guide the diagnoses phase (Churchman, 1968). Consequently, the Churchman considerations were used in this paper to guide the formulation of questions from the suite of fifteen modal aspects attributed to Dooyeweerd - to be used in constructing the diagnosis phase. Four steps were followed in the investigation, namely (1) studying the application of the considerations to the educational setting, (2) extracting guiding questions from the modalities in the context of the educational setting, (3) applying the questions to the setting, and then (4) reflecting on the similarities and differences observed, based on a mapping of questions to considerations.

In the Critical Social Theory context, Action Research, with its cyclic approach to facilitate a deeper understanding which permit the discovery of power structures by deconstructing the setting, is an accepted method to deal with problems existing in a system (Susman & Evered, 1978). The first phase of Action Research, namely diagnosing the problem, is important, because subsequent phases act on its findings – to reconstruct the setting (Harvey, 1990). Unfortunately, except for the fact that the diagnosis of a problem needs to be achieved in this phase, it is not clear how to achieve this, since no structure or guideline is provided. In this paper, the Suite of 15 Dooyeweerdian modalities (Basden, 2008) is investigated – to determine its value in providing such guidance.

In the subsequent sections, extant literature on the key concepts are investigated to supply the grounding for this paper (Section **Error! Reference source not found.**), followed by a discussion of the empirical focus of this paper where an illustrative case study shows the use of the five Churchman considerations in structuring the diagnosis

phase of Action Research – in the context of an educational study (Section **Error! Reference source not found.**). Subsequently the value of Dooyeweerd’s 15 modal aspects in structuring the first phase of the Action Research process is investigated, by following four steps (Section **Error! Reference source not found.**). The paper is concluded in Section **Error! Reference source not found.**.

## 2 | Frameworks for Understanding

The study on which this paper reports, is set in Critical Social Theory (CST) as paradigm, while Action Research (AR) as methodology guides its cyclic implementation. The focus of this paper is on the formulation of questions aligned with the fifteen modal aspects designed by Dooyeweerd. The application of Churchman’s considerations to the case environment, teaching Systems Analysis and Design (SA&D) to second year students, is used to guide the formulation of questions from Dooyeweerd’s 15 modal aspects and is therefore included in the literature review.

### 2.1 | Action Research in Context of Critical Social Research

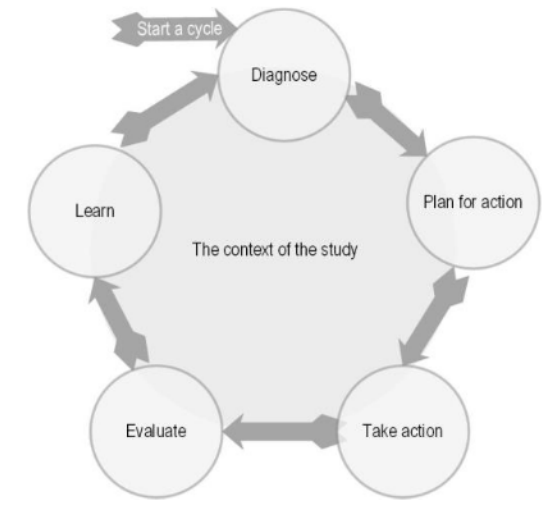
Critical Social Theory focuses on discovering contradictions and conflicts existing in the setting studied. For the critical social theorist, it is important to empower people to enable their emancipation on a social, cultural or political level (M.D. Myers, 1997). In addition, the critical social theorist aspires to critically analyze the present situation, seeking to alter restrictive societal limitations deeply ingrained within the social frameworks being studied (Orlikowski & Baroudi, 1991). The interaction between the people and the process is of interest to the critical researcher, with the aim to remove unjustness (Creswell, 2003).

Three elements guides this process to emancipate the students in the context of studying Systems Analysis and Design (SA&D), namely; *insight* – which illuminates less apparent aspects of understanding reality, *critique* – which aims to challenge assumptions and beliefs occurring in Information Systems (IS) phenomena, but are taken for granted; moving past mere interpretation, to recognize power dynamics, and accomplish *transformation* (Richardson & Howcroft, 2006) – which improves human circumstances by equipping people with relevant knowledge and a practical understanding of the context (Alvesson & Deetz, 2000). Harvey (1990) posits that critical social theorists aim to break down complex contexts into abstract concepts, which is facilitating an analysis of the interconnections between these concepts. By deconstructing the problem scenario into its fundamental components and examining its elements, the pivotal framework underlying the context is unveiled. This disclosure is made possible through a continuous interplay between abstract concepts and tangible data, facilitating transitions between broader societal concepts and specific instances, current structures and its historical development, surface-level appearances, and underlying significance, as well as reflections on the past and practical applications. Subsequently, the identification of oppressive frameworks informs the reconstruction of the context, driving a transformative process.

Michael D Myers and Klein (2011) recognize three primary CST streams: the Bourdieu approach employed in ethnographic studies, the Foucault method utilized in historical studies, and the Habermas theory focusing on communicative action. They facilitate the inclusion of lesser-known theories and promote the introduction of new authors, like the incorporation of Dooyeweerd’s 15 modal aspects into CST, as exemplified in this study. Within the IS context, critical researchers actively engage to impact the technological aspects in connection with the social systems under examination (Ngwenyama & Lee, 1997). Conversely, they are also influenced by these very systems.

Action Research, as a process, permits the examination of a problem through taking action to enhance a situation, employing specific criteria to bring about improvements in said setting (McNiff, 2016). Susman and Evered (1978) suggested five AR phases to be conducted in cycles – in a particular context. These phases guided the underlying study and are depicted in Exhibit 1 and described below.

**Exhibit 1.** AR cycle of five phases as adapted from Susman and Evered (1978).



The five phases of Action Research (AR) are outlined as follows:

1. Diagnosis as phase involves identifying participants to collect data on the current situation within the context.
2. Planning for Action phase is guided by the formulation of an intervention plan aimed at improving specific aspects of the context.
3. Acting as phase builds upon the devised plan, this phase involves implementing interventions to enhance the context.
4. Evaluation as phase assesses the effectiveness of the intervention by using data collection tools such as interviews.
5. Learning Specified as last phase occurs within the practical application realm. A successful intervention yields new knowledge, while an unsuccessful one informs improvements in methodology and theoretical foundations (Checkland & Holwell, 1998).

With the scenario under discussion being a system, Systems Thinking contributes to the investigation, and is deliberated next.

### 2.2 | Systems Thinking

Systems Thinking involves examining entities as complete wholes; it consolidates all pertinent information about them to comprehend them as unified entities (Kay & Foster, 1999). Therefore, a system-as-object includes smaller systems and is seen as part of a larger whole, leading to a structure of systems. A system comprises interconnected components working together to achieve a defined set of objectives (Churchman, 1968). This entirety being discussed exceeds the mere accumulation of its individual components and exhibits emergent qualities not found in any singular part. Specifically, the structures and processes interconnecting within the system give rise to these properties, becoming the central focus of analysis.

Churchman (1968) lists five basic considerations that need to be kept in mind when making sense of a system; what is the purpose of the system, what does the environment of the system look like, what are the resources available to the system, what are the components of the system, and how is the system managed? His considerations are listed and described in Exhibit 2.

**Exhibit 2.** Churchman’s considerations (Churchman, 1968).

Consideration	Systems characteristic
<b>Purpose</b> of the system	The system's purpose is its measurable objective, although it is acknowledged that the true objective may not always be evident and often prioritizes what remains unaffected by other choices.
<b>Environment</b> of the system	The system's environment remains beyond the system's control, yet it significantly shapes the system's objectives.

Consideration	Systems characteristic
<b>Resources</b> available to use in the system	In contrast to the environment, resources within the system can be managed and employed to accomplish the system's goals.
<b>Components</b> of the system	Components within the system function as subsystems, contributing to the attainment of the system's overarching objectives. Each subsystem also possesses attributes akin to those of a system, as outlined in this exhibit.
<b>Management</b> of the system	Management involves orchestrating the resources, which are influenced by environmental constraints, through the system's components to attain the specified objective.

The context of the study this paper reports on is the instructional design of the subject SA&D, presented as a *system*. Interestingly, the subject content also follows a systems approach, namely Soft Systems Methodology (SSM), where the hypothetical and non-prescriptive Framework for the Application of Systems Thinking (FAST) methodology is suggested and followed in the prescribed book (Bentley & Whitten, 2007). Checkland (1991) introduced Soft Systems Methodology (SSM) to analyze and enhance social systems which address areas of concern. In its design, SSM incorporates a learning phase to facilitate continuous improvement to benefit those involved (Stowell, 1995).

Action research is used to study the problem setting, after which a conceptional model is built. These are then compared to the real-world environment to determine changes that will resolve the problem situation to be implemented. In the educational system of SA&D, the diagnosis may be directed by Dooyeweerd's 15 modal aspects, they are: Quantitative, Spatial, Kinematic, Physical, Biotic, Psychic, Analytic, Formative, Lingual, Social, Economic, Aesthetic, Juridical, Ethical, and Pistic. The description of each modal aspect is listed in Exhibit 3 in the subsequent section.

### 2.3 | *Dooyeweerd, the Man and his Philosophy*

Herman Dooyeweerd (1894-1977), a Dutch philosopher, is notable for his theory of modal aspects, describing fifteen aspects of reality. He contends that these aspects offer a comprehensive framework for conceptualizing and understanding all dimensions of reality, thereby serving as a foundation for theoretical understanding (Dooyeweerd, 1969).

Dooyeweerd, born in Amsterdam on October 7, 1894, was raised in a Calvinistic household (Henderson, 1994) and drew influence from reformed protestant Abraham Kuyper (Kalsbeek, 1975). His academic journey encompassed various roles and achievements: beginning with legal studies in 1912 and culminating in his doctoral dissertation, "*The Cabinet in Dutch Constitutional Law*", submitted in 1917 (Henderson, 1994). He held diverse positions from 1916 to 1926, spanning roles in taxation, municipal government, national labor relations law drafting, and research for the Abraham Kuyper Foundation (Kalsbeek, 1975). In 1926, he transitioned back to academia, becoming a professor of legal philosophy at the Free University of Amsterdam until his retirement in 1964 (Basden, 2000).

This path enabled Dooyeweerd to participate in structured contemplation on politics and make contributions to sophisticated political journalism. He played a pivotal role in establishing the philosophy of the Cosmonomic Idea, which embodies a perspective of general truths guided by ethical principles and augmented by philosophical insight. This framework aims to raise awareness of the world's spiritual divisions and confusion, while also fostering responsible life direction (Kalsbeek, 1975). Dooyeweerd died in 1977 (Henderson, 1994). With a background in politics and law, Dooyeweerd rejected the notion of constraining philosophy to singular domains like politics, mathematics, or other sciences (Basden, 2008).

In order to encompass all aspects of life, Dooyeweerd (1984) formulated a series of transcendental conditions, subsequently translated and summarized by Henderson (1994). Basden (2008) concisely outlines these conditions as follows:

- Everyday life must be respected rather than treated as mere theory.
- Theoretical thought is not neutral; it arises from pre-theoretical foundations.
- Philosophy should harmonize scientific knowledge and daily experiences, fostering insights into their interrelationships.
- Philosophy should remain receptive to issues spanning diverse disciplines.

Thus, Dooyeweerd's framework offers distinct advantages: it centers on daily life instead of specific agendas, it maintains coherence, and comprehensively covers a wide array of aspects, it draws upon millennia of cultural and reflective heritage, and provides a philosophically rooted grasp of aspectual nature (Basden, 2018).

A system is characterized as an entity striving to achieve specific objectives, comprised of interconnected elements (Ackoff, 1971; Churchman, 1968). Dooyeweerd presents fifteen modal aspects that offer guidance for system diagnosis. These aspects, showcased in Exhibit 3, are accompanied by illustrative examples of their qualifications. Each aspect holds a core meaning, alongside retrocipation and anticipation of latter or former aspects. This interrelation is essential, as each aspect inherently corresponds to others, with retrocipation reflecting a connection to preceding aspects and anticipation indicating a link to subsequent ones (Basden, 2008). Additionally, Dooyeweerd emphasizes the concept of individuality structures, referring to distinct entities or events possessing unique attributes which set them apart (Kalsbeek, 1975). While aspects focus on "how", individuality structures prompt the question "what", encompassing their distinct modes of existence. Thus, modal aspects serve as the foundation for understanding individuality structures in theoretical analysis, facilitating a holistic comprehension.

To facilitate memorization, Basden (2011) categorizes the 15 modal aspects based on their essence—function or beneficial impact—resulting in five categories: mathematical, pre-human, individual human, social, and societal structures (Exhibit 3), although this categorization was not proposed by Dooyeweerd.

**Exhibit 3.** The fifteen modal aspects of reality identified by Dooyeweerd; listed as types of things by qualifying aspect as discussed by (Basden, 2008) and using the good it brings Basden (2000).

Aspect	Meaning	Example things	Good
Mathematical aspects			
Quantitative	One, several, many; more or less	Amount, Proportion <representing quantity>	Reliable amount
Spatial	Here, there, between, around, inside, and outside	Shape, Distance, Angle, Direction <representing size>	Simultaneity, continuity
Kinematic	Flowing and going	Path or route, Flow <representing movement>	Change
Pre-human aspects			
Physical	Forces, energy, and matter	Solids, Fluids, Gases; Energy, Waves, Particles, Materials, Fields, Forces <representing interaction>	Irreversible persistence and causality
Organic	Living as organisms in an environment	Plants; Organism, Organ, Tissue, Cell; Animals <representing life functions>	Sustained being and functioning that is not controlled by the environment
Sensitive	Feeling and responding	Sound, Color, Feeling, Emotion, Excitation <representing feeling and sensing>	Interactive engagement with the world
Aspects of human individual			
Logical	Conceptualization, clarifying, categorizing, and cogitating	Concepts; Distinctions, Deductions, Awareness <representing concepts and logic>	Independence from the world; conceptual and theoretical thinking
Formative	Deliberate creative shaping of things	Goal, Achievement, Forming, Will, Tool, Skill <representing history, culture, and technology>	Achievement, innovation
Lingual	Expressing, recording, and interpreting	Word, Sentence, Book, Writing, Utterance, Diagram, Index <representing communication>	Externalization of intended meaning; referring beyond to whole web of meaning
Social aspects			

Aspect	Meaning	Example things	Good
Social	We, us, and them; relating, agreeing, and appointing	Friendship, Institution, Status, Respect <representing relationship and community>	Togetherness
Economic	Managing limited resources frugally	Resource, Limit, Production & consumption, Money, Management <representing skilled use of resources>	Sustainable prosperity
Aesthetic	Harmonizing, enjoying, playing, beautifying	Music, Sculpture, Cuisine, Humor, Fun, Sport, Nuance <representing interest and fun>	Delight that seems non-necessary
Aspects of structure of society			
Juridical	Due appropriateness, debt and reward, structures of policy and legality	Responsibility & rights, Reward & punishment, Laws <representing rights and responsibilities>	Due for all
Ethical	Attitude, self-giving love	Act of generosity, Sacrifice <representing love and generosity>	Extra goodness, beyond the imperative of due
Pistic	Vision, commitment, certainty, and belief; aspiring, trusting, worshipping	Religions, Ideologies; Faith, Trust, Loyalty, Worship, Commitment, Ritual <representing faith, commitment, and vision>	Courage, hope and openness to the Divine; change in the attitude and direction of society

Using guiding questions formulated from Dooyeweerd’s 15 modal aspects, in the context of a system, allows the researcher to start the deconstruction process at the start of the AR process; by means of deconstructing the setting according to the fifteen guiding modalities.

### 3 | Illustrative Case Study

The instructional design of SA&D is presented as an illustrative case study to show an example of how Churchman’s considerations may be applied to the diagnoses phase of an AR cycle.

In this section, the SA&D context described depicts the situation initiated when the researcher began teaching the subject modules in 2011. This pertains to the context at North-West University, situated in South Africa, encompassing multiple campuses: Potchefstroom (PC), Mafikeng, and Vanderbijlpark (VC). Initially, each campus operated independently, although there was alignment between certain courses.

The VC, the smallest campus with fewer than 10,000 students at the time, closely mirrored the demographics of the South African population. The Baccalaureus Scientiae in IT course was partially aligned with the same course offered at the PC. Systems Analysis and Design constitute two consecutive 16-credit modules across a year, presented during the second year of the course. These modules or either of them are also included in various other Baccalaureus Scientiae courses.

Annually, most students attending the VC class comprise black South Africans (over 85%), followed by white South Africans (less than 10%), and then members of the South African Indian and colored communities (approximately 2% each). Additionally, a small percentage includes Black international students (close to 1%). A large number of students face financial challenges, commute long distances, experience housing shortages, and some even struggle with malnutrition. Furthermore, a considerable number of students are parents.

The SA&D subject consists of two modules: SA&D I – focusing on systems analysis and SA&D II – focusing on systems design, with an emphasis on systems implementation and support. The course teaches the IS development life cycle, employing the hypothetical FAST methodology. The outcomes of these modules are articulated in terms of knowledge, skills, and attitudes, representing students’ expertise, experiences, and individual talents related to the coursework– in Exhibit 4.



**Exhibit 4.** Outcomes of SA&D.

Capability	Systems analysis and design I	Systems analysis and design II
Knowledge	Upon completion of the module the student will be able to demonstrate that they accumulated sufficient knowledge of, and insight into the phases and techniques of the systems development life cycle to be able to apply this knowledge to the planning and analysis.	Upon completion of the module the student will be able to demonstrate that they accumulated sufficient knowledge of, and insight into the phases and techniques of the systems development life cycle to be able to apply this knowledge to the planning and design of a system. Although the implementation of a system is not the primary focus of this module, implementation is important to determine the value and success of the analysis and design.
Skills	Upon completion of the module the student will be able to prove that he/she can apply the phases and techniques of systems development in the context of a project. Students must be able to manage a practical project by using project management techniques. The student will be able to think and act creatively and with a view to solving the problem at hand when a computerized system is analyzed. Group work must be completed successfully.	Upon completion of the module the student will be able to prove that (s)he can apply the phases and techniques of systems development in the context of a project. Students must be able to manage a practical project by using project management techniques. The student will be able to think and act creatively and with a view to solving the problem at hand when a computerized system is designed and developed. Group work must be completed successfully.
	Systems are developed for users, and their preferences and working methods must be considered during systems analysis.	Systems are developed for users, and their preferences and working methods must be considered during systems design, therefore the analysis completed in SA&D I should be according to the needs of users.
Attitude	Systems analysis must be completed accurately and according to the agreed upon manner.	Systems design must be completed accurately and according to the agreed upon manner. System implementation is also undertaken to assess the success of both the systems analysis and its design.
	Information about the client should be treated with the necessary confidentiality.	Information about the system should be treated with the necessary confidentiality.
	Computer resources should be used ethically and responsibly.	Computer resources should be used ethically and responsibly.

The learning resources relied upon to aid students in comprehending concepts are outlined below:

- **eFundi**, the university's learning management system widely used by academic staff, has been an integral part of SA&D since 2011 and is continually expanded upon in subsequent offerings.
- While textbooks are typically considered standard in university classes, this **textbook** serves as an extensive resource for students, offering valuable references and guidance for their future careers.
- **Slides**, closely aligned with the textbook, serve as concise summaries of the coursework.
- At the outset of each class in semester 1 or before class begins in semester 2, a brief 5-mark **baseline assessment** (class test) is administered to gauge students' prior knowledge of the upcoming material.
- Given its residential setting, students have the advantage of attending conventional **classes** in semester 1 and flipped classes in semester 2.
- Project work is crucial for discipline-specific learning in a computing environment, and in support the aim of **class activities** is to apply studied concepts, with support from peers and the instructor.
- **Assignments** are designed to formally implement practical applications of concepts, again in support of project work which remains the preferred discipline-specific learning method in SA&D.
- **formative assessment opportunities**, such as semester tests, facilitate feedback that aids students in grasping the material, contributes to their participation grade, and helps prepare for the final examination.

- A **group project** mirrors real-life IS projects, allowing students to collaborate closely with peers and depend on each other's contributions.

The components contributing to students' participation grades include the weekly class tests, assignments, semester tests, and the group project.

#### 4 | The Value of Dooyeweerd's 15 Modal Aspects

With the purpose to develop a set of questions from Dooyeweerd's 15 modal aspects – to guide the diagnosis phase of AR – the following steps were followed:

1. The use of Churchman's considerations– as an example.
2. The compilation of a list of questions from Dooyeweerd's 15 modal aspects – to guide the diagnoses phase.
3. The list of questions from Dooyeweerd's 15 modal aspects are applied – to a generalized version of the same cycle of the case study.
4. Reflecting on the similarities and differences between Dooyeweerd's 15 modal aspects and Churchman's five considerations in this context, based on a modality–consideration mapping.

It is important to note that the focus of this paper is not on the learning that took place in the case study, but rather on the development of a set of questions.

##### 4.1 | *The Five Churchman Considerations, Applied to the Case Study*

With the commencement of an AR cycle, the Churchman considerations (Churchman, 1968) steers the understanding of the context of the study under discussion in the diagnosis phase (Exhibit 5). It encompasses five considerations of a system, specifically examining the educational system of SA&D: purpose, environment, resources, components, and the management. This exhibit centers on the instructional design of the SA&D module for a group of second-year students, conceptualized as a system within the framework of Systems Thinking.

**Exhibit 5.** Using Churchman's considerations to diagnose the study.

Item	Diagnosing the instructional design of SA&D
Purpose	<p>The objective of the instructional design as a system, is to guide each student to develop in terms of their SA&amp;D skills, and as life-long learner. Therefore, the lecturer envisages supporting all students to participate to their full capacity by making focused resources available to them, and to support them to utilize resources according to their individual needs.</p> <p>Although continuous learning is important in the workplace for all employees, even more so in an IT career, with the constant development of technology and its supporting applications. Although emphasis is placed on pass rate in the university context, the overall purpose of the instructional design was on enriching the learning environment to ground future learning.</p> <p>In support of the educational purposes, the classes are developed to stimulate students to direct their own learning using videos and other instruments. Seeing students struggle to prepare for assessments, especially while off-campus, motivated the use of their already existent mobile devices to support their learning. An opportunity to form part of a group of academics to pilot the implementation of interactive electronic study guides, opened the way for the inclusion of a technology instrument in the form of an interactive electronic guide.</p>



Item	Diagnosing the instructional design of SA&D
Environment	<p>The environmental aspects of this study are:</p> <ul style="list-style-type: none"> <li>• Poor socio-economic background of students.</li> <li>• Limitations in practical laboratories on campus due to sharing of computer laboratories among disciplines.</li> <li>• Specific functionality of the LMS outside campus boundaries.</li> <li>• Limited contact time: at the VC limited time were allocated to SA&amp;D, initially with two double contact sessions, each lasting 80 minutes, and (during the last classes related to this research), a short double contact session of 75 minutes and a long double contact session of 90 minutes were allocated, one allocation for a theory class and the other allowing practical work.</li> <li>• Limited study hours per module in the curriculum, 160 study hours of which the majority is outside formal contact hours, of which most is reliant on computer laboratories.</li> </ul>
Resources.	<p>Resources include eFundi as learning management system, a text book with useful references, slides which summarized the material covered, class tests which determined students' pre-knowledge of the material to be covered in class, class offerings, informal class work, formal assignments, semester tests to prepare students for examinations, a group project to simulates real life projects and teaches students to work with peers.</p> <p>The instruments which contributed to participation marks, include class tests and assignments, conducted weekly, semester tests and the group project.</p>
Components	<p>Different strategies for dividing the systems into components are possible. These include (1) focussing on teaching as one component and learning as another, or (2) focusing on different study units as components..</p> <p>The discipline, in this case IT, is important, where teaching and learning should take place in such a way that promotes <i>the way things are done</i> in IT. In the case of SA&amp;D – in each of the two components – teaching and learning are broken down into 10 study units completed over 10 weeks in each of the two semesters.</p> <p>The act of teaching is juxtaposed with that of learning, which is both the responsibility of the students as learners, and lecturers as learners. Students are learners of the subject matter offered, skills required in the application of the material, and the attitudes supposed by the students in applying the material. Lecturers are expected to gain knowledge, skills and attitudes in teaching the subject module material.</p>
Management	<p>To understand the coordination of the resources and the environment of the SA&amp;D module, information is presented on the individual semester modules. The focus of the first semester subject module being systems analysis, includes background information, project management, and the activities encompassed by the phases of systems analysis (requirements gathering, use-case modelling, data modelling and the analysis of the data, process modelling, and feasibility analysis). The focus of the second semester subject module is systems design, which include the activities encompassed by the phases of systems design (application modelling, database design, output design, input design, and user interface design). Although system construction and implementation, along with systems operations and support, are strictly not part of SA&amp;D, these two phases are also addressed to allow students to experience the effects of the analysis and design they have done for their system. Lastly, object-oriented analysis and design are included in the syllabus.</p>

For the purpose of this paper, the contents of the exhibit above have been condensed, while still reflecting its essence.

#### 4.2 | Guiding Questions from Dooyeweerd's 15 Modal Aspects

A list of questions was formulated from Dooyeweerd's 15 modal aspects – to guide the diagnoses phase (Exhibit 6). The five categories, namely mathematical, pre-human, the human as individual, social, and the structure of society, as included in Exhibit 3 above, is retained.

**Exhibit 6.** List of questions formulated from the 15 Dooyeweerdian modal aspects – to guide the diagnosis phase.

	Aspect	Question(s)
Mathematical	Quantitative	How are student retention rates affected by the teaching approach? Are there quantitative indicators of students struggling to comprehend complex subject matter?
	Spatial	How does the arrangement of teaching materials and resources align with students' learning styles? Are there spatial challenges which impact curriculum effectiveness?
	Kinematic	How smoothly do students progress through the curriculum? Are there disruptions in the flow of concepts and learning materials impeding student advancement?
Pre-human	Physical	Are there any physical limitations affecting the quality of teaching and learning?
	Organic	How does the interaction between students and teachers impact engagement and inclusivity? Are there challenges related to collaboration and fostering a conducive learning environment?
	Sensitive	What are the cognitive processes, emotional responses, and motivational factors influencing the learning experiences of students? Are there mental barriers that hinder effective learning?
Human as individual	Logical	How logically coherent are the pedagogical approaches? Are there gaps in content delivery or knowledge transfer that need to be addressed?
	Formative	How creative and effective are the design processes of instructional materials? Are there shortcomings in the development of content that affect comprehension?
	Lingual	Are communication channels and instructions linguistically clear and easily understood by students? Are there areas of misunderstanding or confusion due to language?
Social	Social	How well do the educational materials align with cultural values and societal norms of students? Are there ethical or cultural challenges that affect the success of instruction?
	Economic	How can cost-effective solutions be implemented for learning materials and resources? Are there financial barriers impacting access to education by students?
	Aesthetic	What design elements influence engagement and motivation of students? How can the aesthetics of learning materials be enhanced to promote effective learning?
Structure of society	Juridical	Are the educational practices compliant with regulations and privacy concerns? Are there legal and ethical considerations that need attention in the teaching process?
	Ethical	How can the lecturer and student go beyond the imperative of due?
	Pistic	How well do the teaching practices align with students' educational aspirations and values? Are there discrepancies affecting motivation and commitment of students – to the subject matter?

Questions were formulated to reflect the meaning of each aspect and focus on the good it brings. Note that the questions were formulated by an individual (the researcher) and may differ from the formulation of another individual.

#### 4.3 | Dooyeweerd's 15 Modal Aspects, Applied to the Case Study

With the purpose of illuminating the application of Dooyeweerd's 15 modal aspects to the diagnosis of a generalized version of the system; teaching SA&D to second year university students, is discussed, using the five groupings relayed in Exhibit 3. In the discussion aspects were either highlighted, or added in brackets, and highlighted.

From a mathematical perspective:

- **quantitative** metrics may reveal low retention rates or engagement levels, indicating potential challenges in grasping the complexity of the material,
- examining the **spatial** arrangement of teaching materials and resources may expose dissonance between the content structure and the comprehension of students, and
- disruptions in the flow of concepts and learning materials may hinder the progression of students, highlighting issues in the dynamics of the subject content (**kinematic**).

Regarding pre-human aspects:

- infrastructure inadequacies, such as outdated technology or inadequate resources, can impede effective teaching and learning (**physical**),
- focusing on the student-teacher interaction where social dynamics may expose issues related to engagement, inclusivity, and/or collaboration (**organic**), and
- exploring the cognitive processes of students, emotional responses, and motivational factors can unveil potential barriers to effective learning (**sensitive**).

The human as individual includes:

- assessing the **logical** reasoning in pedagogical approaches that may reveal gaps in content delivery or knowledge transfer,
- investigating the creative and design processes of instructional material may identify shortcomings in content development (**formative**), and
- scrutinizing communication channels and **linguistic** clarity in instructions may highlight areas of misunderstanding or confusion.

Socially there is ethical and societal implications, such as cultural relevance and alignment with student values, which:

- can impact the success of instruction (**social**),
- may allow for exploring cost-effective solutions for learning materials and resources to address financial barriers to education (**economic**), and
- should allow for analyzing the **aesthetics** of learning materials to reveal design elements influencing student engagement and motivation.

The structure of society includes:

- ensuring compliance with educational regulations and privacy concerns which is crucial to ethical teaching practices (**juridical**),
- the uncovering of **ethical** dilemmas in content or interactions may prompt necessary revisions in instructional approaches, and
- evaluating alignment with educational aspirations of students and values can identify discrepancies affecting motivation and commitment (**pistic**).

From the above, examples of anticipation of subsequent aspects include:

- the quantitative reaching towards the logical; "*quantitative indicators of students struggling to comprehend complex subject matter*" reflects on conceptual thinking,
- the kinematic reaching towards the formative, where technology may be used to deliberately and creatively shape an environment, and
- the organic reaching towards the social, where interaction between students and teachers alludes to a social togetherness.

Examples of retrocipation of preceding aspects include:

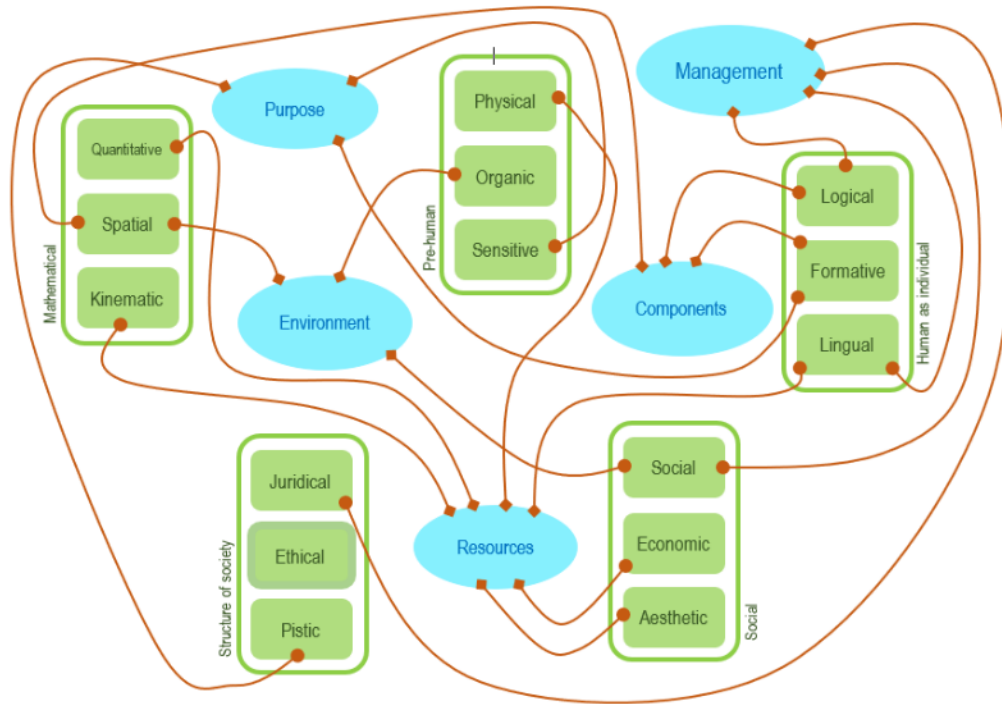
- both the pistic and the economic modalities reaches back to the formative modality; pistic aspirations link to the formative focus on achievement, and cost-effective economic solutions may be manifested through technological implementations, resulting in "*sustainable prosperity*".

This interrelation is essential and illustrates that each aspect inherently corresponds to others.

#### 4.4 | Reflecting on Dooyeweerd and Churchman

Conceptual mapping is utilized to illustrate how Dooyeweerd's 15 modal aspects relate to the five Churchman considerations (Exhibit 7). Again, the guiding categorization, as shown in Exhibit 3, is retained. The Churchman considerations are shown as blue spheres depicted in anti-clockwise order, while Dooyeweerd's modal aspects are shown as green squares, in top-to-bottom and clockwise order. The ethical modality could not be mapped and is highlighted on the picture.

**Exhibit 7.** Mapping the fifteen modal aspects to the five Churchman considerations.



Again, it should be noted that the mappings were done based on the understanding an individual, following on the formulation of the guiding questions, and may differ from the mapping done by another individual.

When studying the mapping visually, the following is observed:

- Any number of aspects may be mapped to any number of considerations, for instance six aspects (quantitative, kinematic, physical, lingual, economic, and aesthetic) are mapped to the resources' consideration, with as little as three modalities to some other considerations. The opposite is also true, for example the logical aspect is mapped to both components and management considerations.
- All considerations are mapped to aspects.
- One aspect is not mapped to any consideration, namely ethical.
- The five Basden categorizations were purposefully not targeted in the mappings, to refrain from cluttering the mapping representation, but when attempting to make such a mapping, it is clear from the visual representation that the Dooyeweerd modalities are not clustered within Basden's five categories when mapped and it therefore does not make sense to map it to Churchman's five considerations.

With reference to Exhibit 5 and Exhibit 6, the application of the Churchman considerations to the case study is compared to the questions formulated per Dooyeweerdian modal aspect, and the following similarities and differences are observed:

- Concerning its **purpose**, both the application and the questions reference the underlying motivation of the student and the importance of developing student capacity, although the questions are referring an expanded view of the learning experience, effectiveness of learning, and the design of the material underlying its development.
- Regarding the **environment**, the application is aimed at limitations, while the questions focus on how the environment's setup may affect the student.
- Pertaining to the **resources**, the application was directed at physical resources, while the questions include resources as well as the relationship between resources and progress, retention rates and aesthetics; and the relationship between financial barriers, cost-effectiveness, communication channels, and flow of concepts and resources.
- Bearing on the **components**, the application addressed teaching and learning, while the questions have the elucidation of the materials used in teaching and its alignment with how students learn in mind; is its creative design effective, is it logically coherent, are there gaps in its delivery, are there shortcomings?



- When it comes to **management**, the application covered the coordination of the subject modules by offering it over two semesters, while the questions crystalized managerial issues such as pedagogical approaches, linguistic clarity and confusion, alignment with student norms, privacy concerns, and ethical considerations from a juridical perspective.
- Only the ethical modality was not mapped to a consideration. It refers to self-giving love, acts of generosity, going beyond the imperative of due, directing the lecturer to be sensitive to situations where students need extra care, but it also implies that students should make sure that they go beyond what is expected, to ensure they learn skills outside the basics provided by a university class. This aspect will be applicable to the system, and all its parts.

When reflecting on the above, the modalities provide more detailed guidance regarding the challenges awaiting diagnoses in an action research study, when compared to the Churchman considerations. Although Dooyeweerd's 15 modal aspects require a practitioner to develop guiding questions to suit the scenario, in return it allows the researcher to custom design detailed guidance compared to Churchman's considerations, which are formulated and explained to be applied intuitively, and as such complicates the formulation of targeted guiding questions. The modalities allow a more detailed interrogation of the system's diagnostics. It does make sense though, to use the questions developed from Dooyeweerd's 15 modal aspects in conjunction with Churchman's considerations as was done in this study.

## 5 | Conclusion

This paper delved into a complex problem within an educational context. Specifically, it investigated the delivery of two subject modules centered on Systems Analysis and Design. Inquiry was embedded in the Critical Social Research perspective and utilized Action Research to address the inherent complexity, while at the same time avoiding attempts to oversimplify it. The approach employed in this study drew from a prior study where Churchman's considerations were employed. This earlier work involved the initial phase of Action Research, referred to as the diagnosis of the problem, and sought to educe questions from Dooyeweerd's 15 modal aspects. The entire process encompassed four key steps: first, the application of these considerations to the educational context; second, the extraction of pertinent questions from the modalities within this educational context; third, the application of these derived questions to the context itself; and fourth, the mapping of this set of questions to Churchman's five considerations, thereby prompting reflection on the observed similarities and differences. The paper not only underscored the value of Dooyeweerd's 15 modal aspects in this context but also demonstrated how these aspects could be structured using the five considerations put forth by Churchman. This grouping by Churchman's considerations is valuable in clustering the formulated modality inspired questions and should be retained. It was found that the Dooyeweerdian modalities proved to be more explicit in guiding its application when compared to the intuitive guidance provided by Churchman. It provides grounding for a more encompassing probing of the setting, by including a wider perspective, for instance, instead of only focusing on physical resources, resources are included, as well as the relationship between resources and progress, retention rates and aesthetics; and the affinity between financial barriers, cost-effectiveness, communication channels, and flow of concepts in relation to resources.

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