

Inverting VARK

What are the possibilities?

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Abstract— Systems Analysis and Design, a second year subject offered as two modules is offered as part of the Information Technology course at the North-West University's Vaal Triangle Campus. Being sensitive to the learning preferences of the learners, varied opportunities for learners to learn have been developed over a period of time. These include visual, auditory, reading-and-writing, learn-by-doing (VARK), or a combination of these.

Although teaching during the second module uses inverted instruction, the first module uses conventional teaching methods. Learners still struggling with particular concepts after a class, have a repertoire of material to choose from to facilitate understanding.

Since 2015, the first half of the offering was split into two classes to accommodate new enrollments and repeating learners separately. The offering for repeaters requires learners to prepare for weekly interactive classes. In doing so, they may attend the conventional class. They also have access to a wide variety of material and tools to support their learning, done in their own time. To support the inverted VARK notion, the repeating learners are intentionally made aware of their learning preference.

Towards the end of the module offering, these learners have an opportunity to reflect on the new experience compared to their original experience as new enrollments during a previous year, their learning preference, and their learning. At the end of the year they reminisce on the experience by answering a questionnaire.

Keywords—*learning preferences; inverted instruction; systems analysis and design*

I. INTRODUCTION

Systems analysis and design (SA&D) entails two core modules offered in the Information Technology (IT) course at the North-West University (NWU). At the Vaal Campus (VC), learners enrolled for the two modules are from diverse backgrounds; black, white, Indian, colored, foreigners; mostly male and a small percentage of females make up the classes that grew from 50 learners in 2011 to 150 in 2017. Many of the learners are from disadvantaged communities. This fact, along with a decline in government subsidy over a number of years lead to the #FeesMustFall movement initiated middle October 2015 [1]. These two factors magnify the importance of providing meaningful resources that may be utilized to its full capacity.

It is true that learners find the subject modules challenging. This is due to various factors, encompassed by

the fact that learners are expected to become systems analysts which are proficient in two areas of application. Most learners studying information technology are capable technologists, but they do not feel that comfortable in the application environment in which the application system is developed. On the opposite side of the spectrum, the people working in the application environment know all about their business, the data they need; this group can articulate their requirements, but they cannot convert their ideas into a data architecture that will address their needs. For this reason a systems analyst should be comfortable in the application environment as well – to be able to facilitate a solution between the capable technologist and the people working in the application environment.

With the offering of the first of the two subject modules, the focus is systems analysis, and classes are offered in a conventional way. Learners are expected to come to class prepared. For this purpose a baseline test is written at the start of class. Each study unit is then explained in a theory class. This class includes activities which may be completed either individually or in groups. A practical class follows in which each study unit's material is explored by applying theoretical concepts practically. At the end of each week a practical assignment is completed. Initially the assignments are done individually, but in the latter half of the semester it becomes group assignments. A practical group project where an information system is analyzed, designed and developed forms part of the yearly syllabus. During the first offering the practical project is initiated in the fifth week, and groups are expected to develop a prototype representing the look-and-feel of the eventual system.

The second of the two subject modules builds on the first. Its focus is systems design, and classes are inverted. On a weekly basis, learners write an electronic baseline test and hand in version one of the assignment the day before the practical class is offered. During the practical class any questions that learners may have, is addressed. In some cases questions may be asked to learners with the purpose to invite discussion. Class work is completed in class in the project groups. After class the second version of the assignment is completed. This is only applicable to learners who want to improve the first version. With the practical project well on its way, its development occurs continually.

In support of the weekly activities and to facilitate learners to participate to their full capacity, multiple resources are made available to them. These include eFundi, a learning management system (LMS) with all resources and information stored in one place. Since 2014 the two study

guides were replaced by interactive learning guides called SMARTguides, which are downloadable to a number of devices and are used to guide learners through every study unit. Videos on challenging concepts support the material. An instant messaging mobile application, WhatsApp, is utilized to form a group with the purpose to allow learners to ask questions when they are preparing for assessments. Various formative assessment interventions create formative feedback opportunities.

With the growth of the campus, classes grew and the supply of a sufficient number of large venues required the group of learners that made up the first offering to be split. In the quest to form groups that may add value to the learning milieu, the facilitator and management came up with a logical solution. It was decided to form one large group of learners enrolling for the module the first time; and another smaller group allowing learners repeating the module. The first implementation of the two group split occurred in 2015. The focus of this paper is on the new group that was formed.

In the subsequent sections the following topics are addressed, namely a background on learning preferences and its relevance (Section 2), the new context of the repeating group of learners (Section 3), the research design (Section 4), actual feedback from learners (Section 5), and finally, some concluding remarks (Section 6).

II. LEARNING PREFERENCES

In recent years a number of tools were developed to facilitate the identification of an individual's learning preference. In many cases a combination of preferences are more relevant than only one learning preference. Two are very prominently used; the Learning Style Index developed by Felder and Silverman [2] is focused on learners studying in an educational setting, and the Learning Styles Questionnaire developed by Honey and Mumford [3] to inform people already employed. These two models are discussed next.

A. Literature on determining learning styles

The work of Felder and Silverman [2] produced the Learning Style Index which uses five twofaced scales, all related to learning style preferences:

- *active—reflective*; which flexes between those who learn by doing, sometimes in groups and the ones who prefer to work alone and think matters through,
- *sensing—intuitive*; which flexes between people who work with realities and procedures practically to those who innovatively conceptualise meaning,
- *visual—verbal*; which flexes between people who prefer to work with visual matter to those who prefer written and spoken material,
- *sequential—global*; which flexes between those who learn in linear incremental steps, and the system thinkers who view matter holistically, and
- *inductive—deductive*; which flexes between those who move from specific to general, and those who start at the general and move to the specific.

In the author's preface to the Felder and Silverman paper [2], Felder suggests dropping the inductive/deductive dimension. He argues that induction (learning through inquiry or discovery which includes problem-based and project-based learning) is the best way of teaching, while deduction (starting with basics and proceeding to applications) is the traditional way of teaching. Felder highlights two issues here; namely that inductive teaching is in-concise and non-prescriptive making it difficult to make sense of it, and deductive teaching is preferred by surface learners – they only want to know what they need to study for a test. Rather than run the risk of facilitators "*continuing to use the traditional but less effective lecture paradigm*", it is omitted.

Honey and Mumford [3] developed a Learning Styles Questionnaire in the context of managers in the workplace. They build on the experiential learning theory of Kolb [4] by identifying four types of learners:

- *activists*; active people who enjoy new experiences, intuitively make decisions and refrain from structure,
- *theorists*; think logically, plan systematically, focus on ideas and refrain from involving intuition,
- *pragmatists*; practical people who thrive in groups, will take risks, but avoid reflection, and
- *reflectors*; focus on the meaning of things, they observe, describe, and attempt to predict outcomes.

Honey & Mumford [3] claim that the knowledge of one's learning preferences may support its match to learning activities. According to them, such knowledge may create awareness regarding the extension of one's learning style range by willfully using less intuitive styles. A similar suggestion is made by Felder; since learners from all the identified categories have potential to become excellent scientists, the act of making them aware of their learning preference(s) may guide them. This is especially true for those learners whose learning style (sensing, visual, inductive, active, and global) mismatches that of the typical instructors' teaching style [5].

Making a learner aware of his or her learning preference(s) stems from linking learning styles to a learning cycle which relies on all the identified learning styles and is shown in Fig. 1 below. Felder refers to this notion as "*teaching around the cycle*" [5].

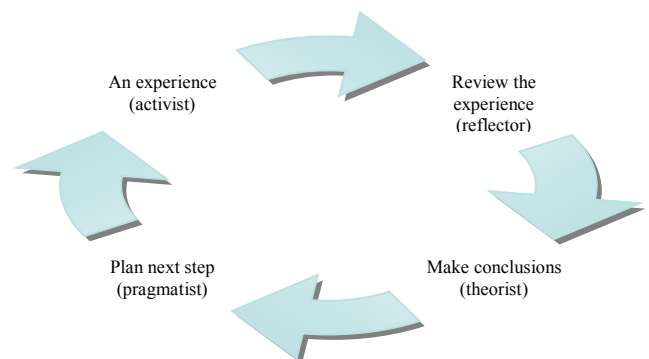


Fig. 1. The Honey and Mumford learning cycle [3]

The simplest learning preference typology was suggested by Fleming and Mills [6]. They expanded on Stirling's [7]

VAK-model with its three categories, namely visual, aural, and kinesthetic, by adding a fourth category. They also developed a learning preference identification questionnaire. The VARK model is the grounding for the approach described in this paper and is discussed in the next section.

B. VARK-model

Fleming [8] introduced four categories of learning, namely visual (V), auditory (A), reader (R)—writer (of the printed word), and kinesthetic (K) learning:

- *Speech* is the most common way to exchange information. It is also referred to as aural learning or learning by hearing and talking.
- *Reading and writing* printed words are the second most common way to exchange information and learn.
- *Visual exchange* of information and learning form the third group. According to Fleming [8] this group is not supported well in the methods used to teach on tertiary level. Visual learners relate to material presented in pictures enhanced with color and layout; including graphs, charts and diagrams. They would also learn by drawing mind maps of learning material and create patterns of material they are making sense of.
- Kinesthetic information exchange is the fourth group. Tactile learners learn through concrete multi-sensory experiences which include touch, hearing, smell, taste and sight. They typically learn by doing, but material that is abstract or conceptual, but presented through applications in the form of real life examples, analogies, or metaphors are assimilated well. Similar to the third group, this category of learners prefer role plays, games and experiential activities which are not utilized often. Fleming [8] includes problem-based teaching with its multitude of modes as kinesthetic.

Although the fourth category, kinesthetic learning, claims learning by doing – it is interesting to note that the other three categories juxtaposes the more passive hearing with the more active talking, the more passive reading with the more active writing, the more passive observation of visual material with the more active compilation of visual matter. In the first three groupings it is therefore also necessary to perform actions in order to learn effectively.

C. Learning preference relevance

Although the literature on learning preferences and its relevance in the classroom is extensive, diverging opinions exist. According to Kalnishkan [9] learning occurs effectively when the learning style of the learner corresponds to the presentation style of the facilitator. If there is a mismatch, the learner will be hindered in their learning despite the best intentions and best efforts of the facilitator. This implies that only a fairly small part of any class of learners (those that are at once intuitive, verbal, deductive, reflective and sequential) will learn effectively in a traditionally presented class [5]. Connecting Kalnishkan's statement to the premise of Lage, et al. [10], as well as that of Rohrer and Pashler [11] that individuals learn with a variety of learning styles; the traditional class cannot accommodate the full repertoire of learning preferences without at least investing much more time in teaching and possibly involving more than one facilitator. In their paper, Pashler, et al. [12] test and contradict what they call the

meshing hypothesis “*according to which instruction is best provided in a format that matches the preferences of the learner*”. Contradictory to them, Felder is of the opinion that “*major transformations in teaching style are not necessary to achieve the desired balance*” when he suggests that some material should be made available to learners before class to make time available for activities that are more practical and visual in nature and allows for cooperation with peers, as well as reflection [5]. His suggestion reflects the inverted classroom which is excellently situated to support all learning preferences by focusing classroom time on activities as suggested above, especially when learners have access to a wide variety of material when preparing for such classes. This approach enables one facilitator to focus on the outcomes of the planned intervention while learners may choose the best individual path to prepare for an interactive session.

Pashler, et al. [12] state that “*the optimal instruction method is likely to vary across disciplines*”, which the researcher deem important in this study; since in the constantly evolving IT-environment, the IT-specialist need to find his or her own answers to construct new knowledge which to some extent is mimicked by the inverted classroom. In their endeavor to make sense of learning style theories, Willingham, et al. [13] came to a similar conclusion – that there are discipline-specific ways in which to teach its concepts.

Interestingly, Komaraju, et al. [14] found a link between personality traits, learning styles and success. Among other traits, cooperation among learners predict academic achievement. This forms a strong link with the Information System Development (ISD), where project work requires cooperation among team members.

Importantly, inverted class for the repeaters accommodates all the aspects necessary for optimal learning; knowledge about one's learning preference(s), applying this knowledge pro-actively, and the facilitation (teaching) of learning that accommodates all learners.

III. A NEW CONTEXT

The division of the original group of SA&D learners opened up new opportunities with regards to the repeating learners. Since these learners completed the first offering during a previous year, they were already exposed to all the activities that the newly enrolled learners do, only during a previous year.

A. A small group with pre-knowledge

The fact that the repeating learners did not pass the module may be due to any of a number of reasons such as personal problems, low motivation, or other obstacles. In addition to their pre-knowledge facilitating the scaffolding of new knowledge, the smaller group enables a more focused approach from the facilitator. With this in mind, it was decided that this group should start with their group projects immediately, that they will not be required to write the baseline tests, and that they will not be required to do assignments. The repeating learners are required to write the semester assessments, and also to complete their projects – in accordance with the requirements for newcomers. To allow them to build participation marks, three additional

interventions were designed in accordance with their needs. By design it inverted the class.

To accomplish the first intervention, the study units covered by the offering were divided into three categories:

1. *Theoretical concepts* that supply background information, create context, and explain a variety of methodologies that may be applicable to systems development, including the hypothetical Framework for the Application of Systems Thinking (FAST) methodology, which is the focus of the offering [15].
2. Concepts with a *strong theoretical component, as well as a practical component*.
3. *Practical concepts* that rely on knowledge of facts, but are best illustrated and studied through its implementation in a case environment.

Table 1 relates the content included in each category listed.

TABLE I. CONTENT PER CONTENT CATEGORY

Category	Type of study unit	Content
1	Theoretical underpinnings with little potential to apply practically	The value of SA&D, the components of information systems (IS), developing ISs, and systems analysis.
2	Equal reliance on theory and its implementation	The project management cycle and the implementation of its tasks, and the techniques pertaining to data gathering for the discovery of requirements.
3	Practical implementations with little theoretical knowledge required	The development of use-cases, data modeling and data analysis, process modeling, and feasibility analysis.

In the design of the inverted classes, it was decided to incorporate interactive activities that have an underlying competitive nature. To accomplish this, the project groups are used to allow learners to rely on the combined knowledge within their groups, as well as strengthen the relations among group members – while groups compete against one another. All interventions are completed in one hour. The three categories of study units were matched with three types of competitions:

1. *Quiz*: Theory is covered by simple questions to be asked in a quiz-format.
2. *Happy hour*: The material relying on theoretical and practical knowledge is covered by a fun activity.
3. *Expert witness*: Material relying on practical implementations are covered by the simulation of case studies solved by expert witnesses such as would be encountered in a court of law.

Table 2 explains the format of the quizzes, happy hours, and expert witness sessions.

TABLE II. COMPETITION FORMAT

Activity	Actions	Assessment
Quiz	In preparation the groups compile questions with accompanying answers due the day before class.	Half the potential marks are allocated according to three criteria; enough questions, complete answer per question – with reference to the appropriate page number in the prescribed text book, and involvement of group members.

Activity	Actions	Assessment
	Each group is allowed to ask a question to a next group. Succession of questions occurs in a round robin fashion. A particular question is directed at a particular group; they have limited time to answer and earn points when supplying the correct answer. If not, the next group in line gets an opportunity; with less time available and the potential to earn less marks, and so on.	According to each group's performance in the quiz, and their attendance, they are allocated the outstanding half of the marks.
	The points are added up and a winning group is announced.	
Happy hour	A student assistant compiles a succession of questions, typically slightly more involved than the typical quiz-question.	
	In class each group appoints an arbiter, a scribe and a runner with the rest of the group (3 to four members) responsible to find answers to questions posed.	
	The format is as such; a question is asked and groups investigate the answer, when the answer is found, the scribe writes it on a piece of paper and the runner takes it to the group of arbiters sitting at a table in front of the class. As soon as the first question is delivered, the arbiters counts to 30. The groups still searching for an answer can deliver their answers during this timeframe. When the time is up the answer is displayed and the arbiters decide the points allocated to each group. As the hour progresses the count to 30 are lessened to 15, and at last to 10.	According to each group's performance and attendance, they are allocated marks for each happy hour.
	The points are added up and a winning group is announced.	
Expert witness	A student assistant prepares a case study and asks one question.	
	The case study-question combination requires each group to compile an implementation in a restricted timeframe. Upon completion each group is allowed to explain their answer to the other groups, and answer any questions. Finally a model answer is displayed.	According to each group's performance and attendance, they are allocated marks for each expert witness session.
	By a show of hands a winning group is announced.	

The second intervention entails a reflective assignment where learners include their learning preference(s), what worked for them during the semester, and what did not work well in their endeavor to understand the material and build a good participation mark. They are also requested to include a wish list including new interventions that they think may assist future learners in learning the material. This intervention supplied the facilitator with feedback on how the available material is perceived and utilized. This intervention has a dual purpose; in addition to contributing to participation marks of learners, it also supplies the facilitator with feedback and suggestions for future changes to the SA&D subject modules.

The third intervention draws on an activity included in the second offering where the project groups are required to do a weekly presentation of project implementations per

study unit. Since the repeating learners are starting with their project work at the start of the semester, this intervention supports the weekly progress of the project work. It also develops the presentation skills of learners and hones their critical voice. In general the succession of presentations improves beyond the expectations of the facilitator.

B. Motivation to study basic concepts

The format of the first intervention explained above invariably facilitates lively, noisy, and very active classes. In general learners have a lot of fun, but also compete seriously. In preparation for an interactive class, each individual may determine their own strategy; including working through the SMARTguide, the text book material, and/or teaching slides uploaded on eFundi – matched to a study unit, participating on their WhatsApp group, working through the reading list, homework, baseline test, and/or assignment supplied per study unit, watching the videos on challenging concepts (or related YouTube videos), and/or attend the theory class offered to the group of learners new to the offering.

In support of their endeavor to become the winning group of the day and in support of their quest for answers to posed questions, learners bring their text books, the e-book version of the text book, slides uploaded by the facilitator, and their own notes to class.

At the end of each class the winning group's members are congratulated, each member gets a lollipop, and a photograph is taken with them in front the recording of their winning points. This is posted on their WhatsApp group. Mostly, afterwards non-winning groups' members congratulate the winning group, but also promise them that the next week's quest will be tougher, resulting in peers vouching to work a little harder.

IV. RESEARCH DESIGN

In the context of the division of the class, learning preferences, the material made available to students to accommodate learning styles, and the activities designed to actively involve learners in the learning process, various feedback opportunities were created. The purpose being to answer the following research question:

Does the inverted class inspire each individual learner to habituate his or her individual learning style preference(s); and in doing so counterbalance the teaching style of the facilitator?

In this paper, the researcher is taking an interpretive stance where the ontological focus is on the world in which the learners function [16]. Thus, there is no objective reality to be discovered; reality is rather socially constructed by the learners [17]. The context of the study is therefore of much importance. Since the study focuses on how the learners assign their own subjective meanings to phenomena as they live in their reality, such a study may not be replicated by others at a later stage [18].

With the purpose of learning from the learners regarding the value of knowing their learning preference(s), the material made available to them to learn the SA&D concepts and its application, as well as the design of the interactive interventions, three dedicated opportunities are created for the purpose of feedback.

At the start of each semester all learners are encouraged to compile an individual learning contract. This contract has a threefold purpose; it has the intention to introduce each learner to the facilitator (a face photo, nickname and surname is included), it is an opportunity for the learner to state the grade he or she is aiming for, and it supplies the cellular contact number of the learner – used to compile the WhatsApp group. As an additional activity, the repeating learners are requested to identify a learning preference identification questionnaire, complete it, and record their learning preference(s).

During the second term of the semester, repeating learners have an opportunity to reflect on the new experience (as compared to their original experience as new enrollments during a previous year), their learning preference, and their learning – in an assignment that contribute towards their participation mark. Table 3 lists the questions asked in the assignment, with the accompanying motivation per question.

TABLE III. QUESTIONS POSED BY MEANS OF AN ASSIGNMENT, WITH AN ACCOMPANYING MOTIVATION PER QUESTION

#	Question	Motivation
1	Indicate your learning style(s) or list yours if you have already identified it. Reference the site you used to identify your learning style and site the authors.	Ensure that learners do know their learning preference(s).
2	Do some reading on your LS(s) and state the major traits of how you should learn – according to the literature (you need to include a list of references AND references in your text).	Ensure that learners have some knowledge on how they learn.
3	Make a list of resources you use when you study (including preparing for class and doing your project) for SA&D I. This may include resources you find on the Internet, your phone, from friends and those you create yourself – in addition to what your lecturer prepared for you. Also include the assignments and class tests you used as a newcomer last year (which you have to refer back to in your preparation this year). SUGGESTION: A tick-list may work well –you list all resources you have access to and indicate which ones you use well.	Determine whether certain resources are more helpful than others (it may also be possible to determine whether there is a correlation between certain resources and learning preferences).
4	Make suggestions regarding the 'gaps' in your learning resources repertoire. How can the lecturer and your infrastructure help you to improve your learning experience? Think of this as your wish-list – in a perfect world. Make sure you describe your request(s) well. Keep in mind that you want to prepare yourself to be a well-rounded systems analyst/designer when you are done with this subject.	Improvements to be considered for implementation in future.

#	Question	Motivation
5	<p>In your project group, do the following.</p> <p>A. Have a brainstorming session.</p> <ul style="list-style-type: none"> List the inputs each team member is likely to give in your group sessions. List good things and bad things, creative and basic things. Switch off the 'I-feel-hurt' part of your brain and be open and honest. Cluster your ideas. Identify gaps (for example if somebody's contribution has been omitted). <p>Every group member should have a list of how they contributed to the group to take home. A list of traits that should be worked on should also form part of this feedback.</p> <p>B. Create a group wish-list regarding the aspects you struggle with in your group – indicate the contributions you miss among your members. It may be fuzzy aspects, as well as skills.</p>	<p>Learning also takes place among peers, especially in a complex project-based environment. The importance of the contribution an individual makes, not only in terms of knowledge and skills, but also soft skills such as diffusing an argument among group members are highlighted through this brainstorming exercise.</p>
6	<p>Reflect on your LS(s) and the feedback you received from your group regarding your contribution(s). Do you find any links? Elaborate on your feelings regarding this.</p>	<p>With this question learners are prompted to reflect on how they learn, on their own, as well as in a group.</p>

After the completion of the first semester, towards the end of the year, only the successful repeating learners from the first semester are requested to reminisce on their experience by completing a questionnaire. At this stage it is hoped that they can place their repeating semester in the context of the initial unsuccessful semester, and compare it to the subject module following on it.

Table 4 lists the questions asked in the questionnaire, with the accompanying motivation per question.

TABLE IV. QUESTIONS POSED BY MEANS OF A QUESTIONNAIRE, WITH AN ACCOMPANYING MOTIVATION PER QUESTION

#	Question	Motivation
1	Were you comfortable to be part of a 'repeating' class group or would it have been better for you to stay in one class with new and repeating learners?	Establish whether learners feel tagged as failures.
2	The repeating class did not follow the format of your first SA&D class during a preceding year. Was the different format where you had to do more on your own working well for you or not?	Determine whether the new format has value.
3	Which aspects (resources) of the SA&D class motivated you to work harder and which ones were stumbling blocks?	Determine whether certain resources are more helpful than others (it may also be possible to determine whether there is a correlation between certain resources and learning preferences).
4	You identified your learning style through the use of a learning style questionnaire. Was the result new to you, or not? Did you learn something about yourself?	Determine how many learners are aware of their learning preference(s).
5	Did you change the way you study after doing the learning style assignment?	Determine whether this particular intervention makes a difference to how these learners learn.

#	Question	Motivation
6	Do you have any suggestions regarding the structure of the SA&D classes for next year?	Improvements to be considered for implementation in future.

V. FEEDBACK FROM LEARNERS

Since its inception in 2015, three repeating groups have been accommodated. In 2015 30 learners made up the class, in 2016 it was 31 learners, and currently there is 31 learners in the repeating class.

A. Learning contract

Since the repeating class of individuals know the facilitator well, and vice versa, the contract becomes less important. Having said that, it is still of use since its focus changes slightly with learners being requested to learn to know their learning preference(s). In all cases the VARK categories were referenced by learners. The completion of learning contracts are as follows; 2015 – 20 with 15 learners indicating their learning preference, 2016 – 22 with 9 learners indicating their learning preference, 2017 – 17 with 9 learners indicating their learning preference.

B. Big assignment

Since not all repeating learners complete the learning contract, the assignment also addresses the issue of identification of learning preferences before asking learners to reflect on the issues listed in Table 3 above. For the purpose of this paper only one of these issues are reported on <ASS:EXP> – as described in the code table, Table 5 below. Learner responses of value is listed in the subsequent Table 6. The information is valuable since it gives some indication as to ideas that learners have regarding including new material to help them in their studies. In 2015 20 learners completed the assignment, in 2016 it was 28 learners, and for 2017 the assignments are in the process of being completed.

Among a multitude of suggestions the ones listed in Table 6 stand out; industry involvement will help to make classes come alive and real. Although visits to IT companies may not be viable, it may be helpful to arrange SA&D experts to talk to learners. Such experts may also motivate learners. Understandably, the quest for owning new technology will assist learners in their quest to be successful in their IT studies.

C. Questionnaire

At the end of the first offering learners who successfully completed it, continue with the second offering. Towards the end of the year learners who formed part of the repeating group of learners are requested to complete a questionnaire. In 2015 13 learners completed the questionnaire, in 2016 it was 16 learners, with the questionnaires for 2017 still to be completed towards the end of the year. Through open-ended questions issues are interrogated: <QNR:CLA, QNR:LPR, QNR:STD> – as described in Table 5 below. Example answers are listed in Table 6.

Regarding being in a repeaters class <QNR:CLA> two learners indicated that they would have preferred to stay in the original bigger class. While two other learners acknowledged the value of a repeating group, they did experience some form of discrimination or isolation. All other learners indicated that the class worked well for them;

they refer to improved participation, the smaller group of learners, and a closer connection to the facilitator.

With regard to their learning preference being new to them <QNR:LPR>, eighteen learners indicated it being new, with two indicating that the information was partly new and 9 said that they knew their learning preference before doing the assignment. Not a single learner indicated that they did not learn something about themselves with regard to how they learn.

The question on whether learners changed the way they learn <QNR:STD>, seventeen indicated being positively influenced, 6 indicated that they tried to adapt to the new knowledge, but went back to their old ways. Another 6 learners indicated that they did not change how they learn.

D. Good-bad-and-ugly feedback

Since learners in a new setting will in many cases not air their problems, a simple feedback measure has been implemented in the SA&D offerings to facilitate feedback to the facilitator. In addition to the three specific feedback measures discussed above, it acts as a fourth general opportunity where learners may supply anonymous feedback to the facilitator. In addition to the formal facilitator feedback implemented by the university once a semester, learners are requested to supply feedback at regular intervals; the good (any intervention that is particularly helpful), the bad (any intervention that is causing anxiety), and the ugly (any suggestions for improvement). This feedback mechanism is utilized every few weeks to ensure quick feedback throughout the semester. During 2015 22 learners provided feedback from one opportunity, in 2016 9 and 8 learners respectively provided feedback during two opportunities, and for 2017 24 learners provided feedback from one opportunity.

From the good-bad-ugly feedback pages the categories <GBU:POS, GBU:NEG, GBU:IMP> – are shown in Table 5 below with Table 6 listing responses that shed additional light on the interventions described earlier:

TABLE V. CODE TABLE

Code	Description
ASS:EXP	Suggestions for expanding the learning resources repertoire.
QNR:CLA	The value of being in a separate repeating group as opposed to being in one combined class.
QNR:LPR	Was the information regarding your learning preference(s) new to you?
QNR:STD	Did you change the way you study after doing the learning style assignment?
GBU: POS	The identification of any intervention that is particularly helpful.
GBU:NEG	The identification of any intervention that is causing anxiety.
GBU:IMP	Any suggestions for improvement.

The good <GBU:POS>; ample feedback was received in terms of how well the new format works. Learners indicate that they are enthusiastic about class, they experience an atmosphere of respect, they are having fun, they work interactively; in general they feel attended to.

The bad <GBU:NEG>; it is encouraging to note that learners did not highlight many items under this category; they complain about not being part of a winning group, the fact that other groups go out of their way to ask difficult

questions, and a very valid issue – some group members not pulling their weight. None of these issues relate to the actual class offerings.

The ugly <GBU:IMP>; a very valid suggestion made by a learner was to share the repeating group's interventions on eFundi. This was implemented with immediate effect and made available to both class groups. One learner enjoyed the class so much that (s)he suggested the format for both semesters.

TABLE VI. RESPONSES FROM LEARNERS

Code	Response
ASS:EXP	R1: "Live presentations given by outside guests who show actual systems and how they and/or their team developed the system from beginning till end." R2: "Take trips to IT companies every once in a while just to get a clear idea of what we working with." R3: "Have a motivational speaker ... to motivate us once in a while."
QNR:CLA	R1: "It did not feel fair at first, as I felt that we were being discriminated and isolated from the rest of the world just coz we failed, but as time went by and I started to attend classes, the class became fun and comfortable. :)" R2: "I enjoyed the smaller class. Was able to participate more than in the larger class." R3: "It would have been better to stay in one class with the new and repeating students." R4: "Yes, but at the same time it wasn't okay to be separated from the rest of the students, this is the only module that we were separated. People repeat a module but they are not isolated from the rest of the class. It classifies us in a bad way." R5: "Repeating class was way better than of newcomers. I feel like you were more concerned." R6: "It was better to be part of a repeaters class, this way we could ask more in depth questions and are less students."
QNR:LPR	R1: "It was not new, but it guided me into methods that improved my learning style." R2: "I discovered that I am a visual learner." R3: "It was new to me. It helped me learn more about what works for me when studying and what doesn't." R4: "Yes, I learnt that I flourish in a smaller group/class environment." R5: "The result was somewhat a surprise which did help in studying throughout the semester." R6: "Not really new, but it rejuvenated my energy to work more and harder and to believe in myself." R7: "Yes, they were new and that's why I passed on my first opportunity, I can pass if I study everything on time, that's what I have learnt."
QNR:STD	R1: "Not entirely but I added some missing aspects that I not notice before the assignment." R2: "I did adapt a few but I failed to maintain it and I changed to old methods." R3: "Yes. I found better ways of studying which helped me improve my results." R4: "Yes. Now I read aloud to myself to comprehend better." R5: "No, I embraced it fully, stuck to it and the results were in actual fact as expected."
GBU:POS	R1: "The way we get marks via happy hour is interesting, having to prep for it helps us to go through the chapters with enthusiasm." R2: "Class is conducted perfectly. There is an atmosphere of respect." R3: "Class is fun and promotes a good learning environment for learners." R4: "The classes are captivating. It is easier to learn in this environment. The competitive spirit in class is good for learning better." R5: "Learning to be more interactive in class, and more competitive amongst one another." R6: "The quiz helps us prepare well for chapters and

Code	Response
	enhances our learning for the module." R7: "Everyone comes prepared to class and gives more time and space to really understand each chapter." R8: "The game gives motivation to study." R9: "Small class so good, one-on-one communication with the lecturer and monitored closely." R10: "I love this class."
GBU:NEG	R1: "Not winning." R2: "Always get asked difficult questions." R3: "Some members do not participate."
GBU:IMP	R1 "Happy hour and quizzes must be shared on eFundi." R2: "Want to play (the quiz) in a way where whichever groups know the answer first should be able to answer the question." R3: "Let us have this the whole semester." R4: "None. This class is awesome."

VI. CONCLUSION

The introduction of a separate repeating class with its instructional design adapted to suit the specific needs of the learners involved has been a gratifying experience from the facilitator's point of view. The fact that these learners already have some knowledge about the subject module which allows scaffolding made the decision to invert the class an easy one. Recognizing the fact that learners learn in their own unique ways, making them aware of their learning preference(s) enabled learners to focus on the material that suits their preference when preparing for the interactive classes.

In collaboration to material made available to learners, activities ensure that the four VARK learning preferences are accommodated. Two modes of learning not normally accommodated [8], namely visual and kinesthetic learning are accommodated in SA&D. This is done through the inclusion of videos and the fact that modeling forms an inherent part of SA&D to accommodate the visual learner; and project-based teaching and learning implemented in the form of a year-long practical project to accommodate the kinesthetic learners.

In most cases the feedback obtained from learners regarding their experience concur with the reflective conclusions of the facilitator. Learners realized that they were expected to take responsibility for their own learning and most of them did rise to the occasion. Although a small number of learners indicated that they did not feel comfortable with the repeaters' class format, most indicated that the changed format helped them to perform better. The large number of learners indicating that the knowledge regarding their learning preference was new to them, taught them how to study more effectively and helped them to change the way they study, is encouraging. Anonymous feedback from learners is in agreement with the feedback obtained from other named feedback mechanisms, with learners being positive about what they learn and how they learn.

From the learner feedback obtained, and discussed in the preceding section, the research question; *"does the inverted class inspire each individual learner to habituate his or her individual learning style preference(s); and in doing so counterbalance the teaching style of the facilitator?"* is considered confirmed – since learners answered overwhelming in the affirmative.

Improvements to the instructional design of the subject module suggested by learners includes the inclusion of talks by experts from the SA&D field that will bring learners into contact with the job environment and motivate them. Such talks will also assist learners to make a connection between the numerous skills to be acquired by them, and the relevance of the skills in the actual job environment.

Discipline-specific teaching; in the case of IT and ISD, collaboration in projects and sourcing knowledge to inform solutions to new problems was facilitated effectively in this study through the implementation of the inverted class. The findings of this research may be of value to facilitators of other computing offerings such as advanced programming and databases where inverted classes may facilitate individualized sourcing of knowledge to solve problems encountered in a project context.

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