In the context of the 21st century focusing especially on education quality, *"High cognitive activation by complex tasks"* reflects one of the key strategies to develop students' competences in a dynamic world. Processes, knowledge and strategies reflected in this monograph serve as the foundation to inspire further reflections on educational quality improvement in Rwanda and similar countries in developing world. The monograph identifies success and risk factors to ignite political, scientific and practical reflections on how educational practices can be innovated.

This monograph provides researchers with new insights for conceptual and empirical studies concerning teaching and teacher professional development. It will inspire policy makers to reflect on curricular policies with emphasis on teachers'pedagogical and didactical skills by pedagogy of teacher education. Practitioners including teachers and teacher educators will find the results of the monograph enlightening in regard to their own teaching practices and professional development.

Emmanuel Niyibizi is a researcher and teacher educator at PIASS-Rwanda. In 2018, Mr. Niyibizi has been nominated as the Director of the Centre for Didactics and Research in Education. In his position, he has initiated different scientific projects including but not limited to the action research on teacher professional learning and teaching quality in Rwanda. His research interests are educational quality with focus on teacher education and teaching; inclusive education and teacher professionalization. He is currently pursuing his doctoral studies at the Bamberg Graduate School of Social Sciences (BAGSS) - University of Bamberg, Germany on *"Teacher educators' subjective theories about quality teaching in Rwanda"*.

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High Cognitive Activation by Complex Tasks in Universities

Brot für die Welt

New Perspectives on Quality Education in Sub-Saharan Africa

Edited by Christine Nyiramana, Susanne Ress, Tharcisse Gatwa, Susanne Krogull, Annette Scheunpflug, and Penine Uwimbabazi

High Cognitive Activation by Complex Tasks: An Engine for Competence-Based Teaching in Higher Education

Emmanuel Niyibizi

PIASS PUBLICATION SERIES N°22

High Cognitive Activation by Complex Tasks

New Perspectives on Quality Education in Sub-Saharan Africa

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Over recent decades, national and international policy actors together with teachers, parents, community leaders, and faith-based organizations have made great progress in providing access to education. Today around the world, more children are in school than ever before. Yet being in school is not enough. These exceptional improvements in expansion of access to schooling require a sustained effort to ensure the quality of education provided in schools. This series presents new findings on dimensions of quality education in the context of Sub-Sahara Africa. The authors in this series have conducted their research in the context of the International Master Program of Educational Quality in Developing Countries (IMPEQ) at the University of Bamberg in partnership with the Protestant University of Rwanda, the Free University of the Great Lakes Region in the Democratic Republic of Congo, and the Evangelical University of Cameroon. The research was made possible through the funding from Bread for the World – the Development and Relief Agency of the Protestant Churches in Germany. The monographs in this series highlight the importance of continuous teacher education and, most importantly, the centrality of efficient leadership for fostering educational policies and practices that meet the needs of all students.

To all who work tirelessly to prepare students
for changing and challenging world especially teachers
and teacher educators.

High Cognitive Activation by Complex Tasks: An Engine for Competence-Based Teaching in Higher Education

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ABBREVIATIONS AND ACRONYMS

CASE:	Cognitive Acceleration through Science Education
CPD:	Contineous Professional Development
EFA:	Education for All
GoR:	Government of Rwanda
HEC:	Higher Education Council
HLI:	Higher Learning Institution
IICBA:	International Institute for Capacity Building in Africa
IIEP:	International Institute of Educational Planning
KIE:	Kigali Institute of Education
MINEDUC:	Ministry of Education
MPAEA:	Mountain Plains Adult Education Association
NCHE:	National Council for Higher Education
NSW:	New South Wales
OECD:	Organization for Economic Cooperation and Development
PGCTLHE:	Post Graduate Certificate in Teaching and Learning in Higher Education
PISA:	Programme for International Student Assessment
REB:	Rwanda Educational Board
SDGs:	Sustainable Development Goals
SSA:	Sub-Saharan Africa
TALIS:	Teaching and Learning International Survey
UN:	United Nations
UNESCO:	United Nations Educational, Scientific and Cultural Organization
VET:	Vocational Education and Training
WB:	World Bank

SERIES EDITORS´ PREFACE

Beyond the fact that the completion of compulsory education has substantially improved over the past twenty years, achieving educational quality for all continues to be a major challenge in Sub-Sahara Africa where many children do not reach basic skills in reading and numeracy by the end of primary school (UNESCO, 2014). A focus on quality education is thus paramount to improve the overall performance of educational systems and to support students' academic achievement. High quality education requires high quality research that combines sophisticated knowledge of educational theories, adequate research methods, and contextualizing sensibilities for local realities as they intersect with global political, economic, social, and historical forces. Every educational dimension imaginable – school access, didactics and pedagogical approaches, academic content and competences – if approached with such a notion of high quality research presents itself as a challenge that poses many questions and few certain answers. To nonetheless forge pathways towards much needed answers requires a sturdy intellect, diligence, creativity, and a supportive community of scholars engaged in critical feedback. Monographs in this series carefully investigate educational concepts and theories as they pertain to quality education in Sub-Sahara Africa.

They cover many topics ranging from leadership skills, competence-based and learner-centered pedagogies, cognitive activation, critical thinking skills, and socially responsive and inclusive approaches to teaching. The monographs go beyond theory in that they reflect on the practical implications of the research findings. The authors provide in-depth analyses grounded in a deep knowledge

of and experiences in the context in which the research was conducted. They articulate recommendations that touch on the macro-, meso-, and micro-levels of schooling. In this way, the series provides a collective space for emerging African scholars to discuss their research on education to impart lessons for mastering 21st century challenges in education everywhere.

High Cognitive Activation by complex tasks in Rwandan higher education: Teachers' experiences and challenges is the next volume in the series New Perspectives of Quality Education in Sub-Sahara Africa. With this, Mr. Niyibizi focuses on the need to find teaching methods that increase the quality of education to better prepare students for their professional futures. Although the quality of higher education has greatly improved in Rwanda, especially in terms of expanding access institutions of higher learning, employers and students alike continue to identify the gap between students' competences and the skills required on the labor market. This book's focus on cognitive activation thus addresses an important factor in educational quality. Mr. Niyibizi provides a broad picture on educational quality in higher education based on an extensive literature review as well as his professional experiences.

Building on this, cognitive activation strategies and the use of complex tasks are highlighted as tools for improving the quality of education. Mr. Niyibizi introduces the challenges and also proposes mitigation measures. His findings show that there is a lack of theoretical knowledge about cognitive activation. Not surprisingly, Mr. Niyibizi subsequently shows that teachers struggle to develop complex tasks and use them rather by coincidence. He therefore concludes that there is plenty of room for improvement and encourages

policy makers and stakeholders, involved in the teaching process, to emphasize pre- and in-service teacher training in this regard. With this study, Mr. Niyibizi presents the scientific community conernced with quality education with much needed insights on the use of complex tasks for cognitive activation in Rwanda and the broader context of Sub-Saharan Africa. Overall, this study has been carried out with high standards of research in social sciences and represents a much-appreciated addition to the knowledge concerning high quality education.

AUTHOR´S PREFACE AND ACKNOWLEDGEMENT

Dynamism and globalising world have led to new reflections on education especially the process of equipping students with necessary competencies to meet the realities and challenges of 21st century. Though access to education has drastically improved worldwide in the last three decades especially developing countries, the actual graduates' competencies are still far from the expected.

In this process, active and participatory pedagogies are advocated as a means for addressing the insufficiency even lack of competencies among school leavers and graduates in Sub-Saharan Africa including Rwanda. Unfortunately, teacher and content-focused teaching methods are still persisting in Sub-Saharan African educational systems including teacher education institutions (Vavrus et al., 2011: 11). Despite the awareness of learner-centered pedagogies, teachers still lack competencies to adopt them in their teaching practices. How can teacher training bring about change among teachers whose previous learning experiences do not match with teaching in the ever changing world?

High cognitive active activation by complex tasks is recognized to drive the development of competencies among students. In this regard, the book at hand is a reflection of how the concept was introduced, implemented as well as empirical reflections about success and risk factors of its implementation. The publication constitutes a reflective model of how innovation can be introduced and implemented in education. Readers will find answers to the following questions: What is high cognitive activation by complex tasks and why is it important in the context of Sub-Saharan African higher education? How is it

related to educational quality especially competency-based teaching? How was it introduced in the Rwandan higher education? What are experiences and challenges encountered while implementing the concept in Rwandan higher education? What are lessons for education researchers, policy makers and practitioners in regard to teacher professional development and introducing change in education?

This book is the result of joint efforts and support from institutions and individuals who deserve special thanks. I unreservedly thank Bread for the World (Germany) for the financial support. The leadership and colleagues at Protestant Institute of Arts and Arts and Social Sciences (PIASS) deserve special gratitude for their support during the intervention and empirical research. Special thanks go to Prof. Dr. Annette Scheunpflug and her team for their professionalism and inspiring quality teaching and research. I am grateful to Dr. Susanne Krogull for her inspiring and cognitively activating feedback on the study. My gratitude goes to Prof. Dr. Maximillian Pfost and Prof. Dr. Barbara Drechsel, as discussants for their stimulating comments, which helped me explore the heights of scientific research in quality teaching. I am indebted to Christine Nyiramana and Ernest Claude Njoya for quality mentorship during my studies. I thank classmates with whom we shared learning experiences. Last but not least, I am thankful to my wife, Magnifique Habumugisha and children: Hero Clever Manzi, Gloire Jabo Manzi and Pistos Hirwa Manzi who not only accepted my long absence at home but also offered moral support during my academic journey.

1

INTRODUCTION

The thesis is about investigating how the concept of high cognitive activation by complex tasks was introduced and implemented in Rwandan higher education. The study was carried out as a contribution to educational quality improvement in the aforesaid context by exploring teaching staff experiences and challenges while implementing high cognitive activation by complex tasks in their teaching practices.

In the context of knowledge-based economy and an ever-changing and globalizing world, education is a key to enable people to get ready to successfully adapt and contribute to sustainable development. A new framework of competences to deal with the complexity of the 21st century related challenges is needed. For this end, people have the right not only to access to education but to a good quality of education (Fredricksson, 2005: 2). Without disregarding other aspects of quality education, teaching is the unreplaceable tool to equip students with necessary competences for successful integration in the global and modernizing society (UNESCO, 2014; 2004). Moreover, research shows that teacher play a determinant role in improving students' achievements (Hattie, 2012: 22-34 & Gauthier & Démbelé, 2004: 2-9). In this orientation, quality

teacher's professional development is one of the key issues of research and practices in the overall reflection on quality improvement, and this concerns all levels of education (UNESCO, 2015: 196).

Though access to education has been tremendously improved in the last two decades, quality still is an issue to be reflected on both in practice and theory (UNESCO, 2014: 84-93). In this framework, there is an overall concern about improving teaching and learning so as to equip students with necessary competences. The reflection of reforming teaching as driving force for competences should go hand in hand with setting policies for increasing qualification of teachers and in-service teacher training (UNESCO, 2014: 233-275 & Vavrus et al., 2011: 85). In the process of improving quality education, higher education has not been left out. Higher learning institutions are recognized to be driving forces for social and economic development and quality improvement for other levels of education (Materu, 2007: 8). Unfortunately, high enrolment doesn't correlate with qualitative improvement especially in Africa (British Council, 2014: 2). The overall reflection of the master thesis at hand is a contribution to the improvement of students' competences in Rwandan higher education. In the first chapter, I describe the context and problem of the study, the research questions and present its overall structure.

1.1 Context and problem

In the thesis at hand, I address the topic of cognitive activation by complex tasks in Rwandan higher education. The thesis is contextualized in the Rwandan higher education system. Introduced in 1963 by the first public National University of Rwanda. In terms of access, higher

education was elitist and based on regional and ethnic quota in line with discriminative policies dominating political administration before the 1994 genocide (Mugisha, 2010; Obura, 2003). Since 1994, there is a political will of widening access to education which led to increase of institutions and enrolments in Rwandan higher education system. The number of Higher learning institutions increased from 1 to 37 (2 public and 35 non-governmental) and the number of students enrolled increased from 3261 to 90803 from 1995 to 2016 (MINEDUC, 2016; 2011). In terms of students, non-governmental represent 58% as compared to 42% enrolled in public higher learning institutions (MINEDUC, 2017: 62). For the purpose of correcting discriminative policies that characterized education system in Rwanda before 1994, access to higher education has been garanteed to all based on merit (Mbabazi, 2013: 8). On the basis of results of the upper secondary national exams, the Ministry of education orient the best performing students in different colleges of the University of Rwanda. The rest of the students may join private higher learning institutions based on the admission criteria to higher education in Rwanda.

Quantitative increase was accompanied by different initiatives to improve quality in higher education. Since 2006, the National Council for Higher Education (NCHE) cum Higher Education Council (HEC) was established to enhance and monitor quality education in Rwandan higher learning institutions (GoR, 2013; 2006). This public organ has been active in setting policies and laws aiming at quality enhancement in public and private higher learning institutions (GoR, 2013; 2010). Policies and laws brought structural change in the administrative and academic organization of institutions of higher education in Rwanda.

At the level of institutions of higher education, the directorate of quality assurance was established in higher learning institutions to regularly and internally monitor quality education within institutions. Additionally, a modular system was introduced to internationalize higher education and introduce student-centered pedagogy as a means to improve students' competences (HEC, 2007c: 8). More on that, English became the only language of instruction at all levels of education since 2008 (MINEDUC, 2008: 11). It is worth to note that French was used as medium of instruction before 1994 in Rwandan Higher education. After 1994 Genocide perpetrated against Tutsi, both French and English were used until 2008 where English became the solely medium of instruction.

With regard to academic staff development, the shortage of qualified teaching staff is still an alarming issue to be reflected in the framework of quality higher education improvememnt (Schendel, Mazimpaka & Ezeanya, 2013: 4). Moreover, to equip academic staff with pedagogical and didactical knowledge and skills, the higher education council recommends a postgraduate certificate in teaching and learning in higher education (PGCTLHE) as a requirement for academic staff (HEC, 2007a: 3). The Kigali Institute of Education – today college of education of the University of Rwanda – offers such training[1]. Apart from the aforementioned requirement for academic staff, policies about continuous pedagogical professional development for academic staff are not quite clear in Rwandan context (World Bank, 2011: 6).

Despite the initiatives to improve quality in higher education, practice and research show challenges to be reflected and

[1] See: https://ce.ur.ac.rw/

addressed. In spite of the political willingness to introduce student-centered methods, transmission-based pedagogy is still dominant (HEC, 2015; Niyikiza, 2014; Mbabazi, 2013; Sibomana, 2010). On the side of educational quality-outcome, students' competences in terms of transferability of acquired knowledge and employability are critical. In a tracer study commissioned by HEC, the findings show that both employers and graduates observe competence gaps in terms of creativity, entrepreneurship skills and risk-taking, problem-solving, communication proficiency in French and / or English, working under pressure, emotional intelligence and critical thinking (HEC, 2015: 54-58). The same research shows that graduates point their fingers to teaching methods used in Rwandan higher learning institutions as the driving cause for insufficiency of competences at the Rwandan labor market. Graduates indicated that decontextualized content and more emphasis on rote memorization are mainly used in Rwandan higher education (HEC, 2015 & Mbabazi, 2013).

With regard to pedagogical professional development of higher education academic staff, it is likely that the training process is done in a similar way, applying the same methodological ideas of rote learning. Introducing teaching quality criteria that fosters active participation in the process of teacher training in the likelihood of transferability to teaching practices could be one of the strategies that improve both quality teacher training and teaching in Rwandan higher education system. Among other criteria of quality teaching, cognitive activation by complex is known to be a driving force for both participation and students' competences (Kanter et al., 2013; Baumert et al., 2010). With this regard, its introduction and integration as a teaching principle into higher education

institutions might be a contribution to improving students' competences in Rwandan higher education system. High cognitive activation by complex tasks in Rwandan higher education as a topic of the thesis at hand is linked to the global reflection of competence-based education in the post-2015 period. In the knowledge- and technology-based economy, educational institutions have the mandate to prepare well-equipped personnel capable of coping with the complexities of work in the 21st century world. Moreover, institutions of higher education are expected to train graduates to serve as engine of social and economic transformation (Materu, 2007: 4: WB, 2009: xx).

In the context of Sub-Saharan African higher education, research shows that the quantitative increase of enrolments was not accompanied by improvement of competences for graduates to meet the requirements of the changing and modernizing labor market (British Council, 2014: 4-6). While there is an increasing unemployment rate among university graduates, employers are complaining about the absence of competent workforce in Africa (ibid. p. 6). This is a reality I experience all my years of teaching in higher education as well as from observations and discussions with colleagues. At the same time, teaching staff are confused about strategies to help students acquire required competences. In the challenging situation, research shows that teaching is the most important aspect that can improve competences (British Council, 2014 & UNESCO, 2014; 2004). Nevertheless, there is mutual accusation between students, academic staff, as well as other stakeholders with regard to who must assume the responsibility of the insufficiency of competences among the school leavers and university graduates. The reflection of the thesis at hand is embedded in the discourse of quality education

whereby students' competences constitute hot debate in research and practice in the post-2015 (UNESCO, 2015: 289). Without disregarding other dimensions, teaching quality remains the most important factor in educational quality improvement (UNESCO, 2014; Creemers Bert, Kyriakides, 2012; Hattie, 2012; Gauthier & Démbelé, 2004; UNESCO, 2004). Research shows that among other criteria of teaching quality, cognitive activation by complex tasks emerges as the most important factor in the process of students' competences enhancement (Burge, Lenkeit & Sizmur, 2015; Krogull, Sheunpflug & Rwambonera, 2014; Kanter et al., 2013 & Hattie, 2012). Moreover, research shows that students learn better when they are cognitively challenged through complex tasks (Burge et al., 2015; Hattie, 2012; Rogers & Horrocks, 2010; Adey, 1999). This means that cognitive activation by complex tasks in teaching and learning process is determinant to competences among students.

In the context of Rwanda, competence-based curriculum was recently introduced in education system from nursery to secondary general education (REB/MINEDUC, 2015). Though it is not yet introduced in Rwandan higher education, initiating reflections on competence-based teaching would be important for two reasons. First, it would be a contribution to quality teaching improvement in higher education in regard to students' competences necessary for competitive labor market. Second, since higher education trains teachers for lower levels of education, it would be better if they are taught using competence-based teaching in order to later implement competence-based curriculum. From the discussion above, research and practice show insufficiency of competences necessary to meet national and global labor market demands as a

result of rote pedagogy (HEC, 2015 & Mbabazi, 2013). Additionally, there are unclear policies about academic staff professional development in Rwanda higher education. Furthermore, research on education quality shows that high cognitive activation by complex tasks is a sin qua non condition for improvement of students' competences (Ehlers, 2013 & Kanter et al., 2013). Unfortunately, the concept is missing in both research and practice on Rwandan higher education didactics. Therefore, there is need for reflecting on how high cognitive activation by complex tasks could be important for improving students' competences in Rwandan higher education.

As a contribution to the global challenge of improving students' competences, the present author organized a training seminar for academic teaching staff of one non-governmental university on high cognitive activation by complex tasks. The training was implemented as a controlled intervention followed by empirical research. The intervention was planned and implemented as starting step to improve educational quality, which is a global concern. As mentioned earlier, high cognitive activation by complex tasks is recognized to be a driving means to improve teaching process and outcomes (Le Donné, Fraser, & Bousquet, 2016; Burge et al., 2015; Krogull et al., 2014; Ehlers, 2013; Kanter et al., 2013 & Baumert et al., 2010). As a new concept introduced in teaching practice of Rwandan higher education, evidences about its implementation enlighten both practice and research through lessons and challenges encountered. To frame the study, the following part shows research questions that guide the study at hand.

1.2 Research questions

Considering the facts related to the global and national challenge regarding students' competences as described in the previous sub-chapter, the importance of high cognitive activation by complex tasks but missing in the context of Rwandan higher education, the following research questions are considered as central to our study. The main research question is: How do academic staff implement cognitive activation by complex tasks in Rwandan higher education? The main research question is subdivided into three sub-questions: How do academic staff cognitively activate students in their teaching? How do teaching staff use complex tasks to cognitively activate their students? And what challenges do teaching staff face when using complex tasks in their teaching? The following part shows the structure of thesis to answer the aforesaid research questions.

1.3 Structure of the thesis

The present thesis is subdivided into seven chapters. The second chapter, the state of research, discursively summarizes relevant literature on the topic under investigation. I start by framing the topic under investigation in educational quality and quality teaching and review literature on high cognitive activation by complex tasks, its relation to quality teaching in higher education, challenges related to using complex tasks and strategies to overcome them as well as high cognitive activation by complex tasks in Sub-Saharan African higher education. I describe the research methodology used in the study. I describe the intervention as method as well as the research methods used in this study in terms of approach, data collection and analysis, sample, challenges and limitations of the study

in chapter three. The description of the intervention in regard to objectives, didactical planning and development of the training is done in the fourth chapter. While the fifth chapter describes the empirical data and gives a summary of results, chapter six discusses the findings in light of the discourse especially teacher professional development. I summarize the findings and show the implications of the study for both practice and research. In the following chapter, I synthetize the state of research related to the the topic under under investigation.

2

COGNITIVE ACTIVATION AND EDUCATIONAL QUALITY

In this second chapter, I summarize the relevant literature related to the topic under investigation. The focus is put on educational quality, high cognitive activation by complex tasks and its relation to quality teaching in higher education, challenges encountered when complex tasks are used in teaching, strategies to overcomes them as well as high cognitive activation by complex tasks in the context of Sub-Saharan Africa. I end the chapter with a conclusion showing the gaps and hence justifying the necessity of the study on high cognitive activation by complex tasks in Rwandan higher education.

2.1 Educational quality

Educational quality is the main and hot debate in post-2015 era within the frameowork of Sustainable Development Goals (UNESCO, 2014 & 2015). The concept as well as how to develop educational quality are major worldwide concerns. In this part, I start by the conceptualization of educational quality. Quality teaching is at the heart of educational quality (UNESCO, 2014: 217-229). Therefore, I describe existing literature on quality teaching with focus on higher education.

2.1.1 The concept of educational quality

The concept of educational quality is a multidimensional and multi-semantic term, which can mean different things to different people and contexts. Despite the complexity of the concept, literature shows distinctive and interrelated dimensions, through which educational quality can be seen, enhanced, monitored and evaluated (Scheerens et al., 2011, 3-54; UNESCO, 2004: 27-37 & Scheerens, 2004). They include but not limited to context, input, process, outputs and outcomes. The context regards all political, social, philosophical; economic factors orienting and influencing education (UNESCO, 2004: 35-36). All resources-human, time and material invested in education system are referred to input (ibid. pp. 35-36). The dimension of process concerns administrative and governance at school level and teaching and learning process at classroom level (Scheerens et al., 2011: 10). The outputs and outcomes are referred to short - and long-term results of education respectively such as number of graduates and their performance at labor market (Scheerens et al., 2011: 10; UNESCO, 2004: 36-37).

Despite the multiplicity of conceptualizing educational quality, learning outcomes- competences are the overall goals of education at all levels (Soomro & Ahmad, 2012; Scheerens et al., 2011; Scheerens, 2004 & UNESCO, 2004). With this focus, improving students' competences has become the major concern of the post-2015 educational agenda (Lange, 2016 & UNESCO, 2015). For equipping students with necessary competences, the international discourse agrees that teaching is at the heart of educational quality improvement (UNESCO, 2015; 2014 & 2004; United Nations, 2015: 6; Gauthier & Démbelé, 2004). It is not surprising that the international educational

orientation aiming at quality education improvement put more emphasis on quality teaching and teacher training as means to enhance students' competences (Göttelmann-Duret & Bahr, 2012; Vavrus et al., 2011 & UNESCO, 2004).

In the context of higher education, without disregarding other important dimensions, teaching and research are two major lenses, through which quality higher education is described and measured (Altbach, Reisberg & Rumbley, 2009 & Teferra & Altbach, 2004). Universities are centers of production and dissemination of knowledge through research (Turner, 2011: 65). Additionally, the mission of higher education is to qualitatively train high quality workforce to meet the requirements of the ever changing and globalizing world. In this framework, quality higher education can be understood in quantitative and qualitative perspectives. Quantitatively, employment rate among graduates (employed or self-employed) and faculty publications –number and journals where they published and citation rate are measured (Marope, Wells, & Hazelkorn, 2013; Huang, 2011 & Buela-Casal et al., 2006). So far as qualitative aspects are concerned, competences of graduates and quality of publications in regard to how research findings are useful to the society are considered as indicators of quality higher education (Buela-Casal et al., 2007: 356). Though the domination of research, teaching has recently been reconsidered in the international university ranking and quality higher education (UNESCO, 2013; Turner, 2011 & Altbach, et al., 2009). Hénard and Leprince-Ringuet (2012: 2) argue that the focus on teaching in higher education is due to different factors including the diversity of students and international competition. Teaching-research nexus is among hot debate issues in the context of quality higher education (Tight,

2016; Jenkins & Healey, 2005).Three concerns emerge from the above literature. First, quality output and outcome dominate educational quality discourse in the context of higher education. Second, quality graduate is debatable, dynamic and varies from context to another. Third, quality process especially quality teaching has remained implicit in the quality higher education improvement. This brings to the question about what teaching quality is and how it is to be observed and enhanced.

2.1.2 Conceptualizing teaching quality in higher education

Reflecting on the concept of quality teaching cannot be separated from learning. Teaching and learning are interconnected and inseparable concepts. They have to be jointly reflected both in theory and practice. Moreover, teaching as process is always reflected in relation to outcome (Lange, 2016 & Biggs, 1999). Quality teaching is to be discussed in relation to the discourse of quality learning. The concept of quality teaching, criteria and role of the teacher are described hereunder.

The concept of teaching quality is complex and can be understood in different perspectives. The concept takes different meanings in relation to development of theories of learning (Doyle, 2011 & Killen, 2009) where the role and position of the teacher and learner vary. In the international educational discourse, learner-centered education is taking prominence in teaching from the influence of constructivism (Vavrus et al., 2011; Hénard & Leprince-Ringuet, 2010 & Doyle, 2011). As opposed to previous theories, constructivism emphasizes the role of the learner in the process of meaning making from experience individually and interactively (Fullan & Longworthy, 2013 &

Snowmann, McCown & Biehler, 2009). In this framework, the teacher is no longer the source and transmitter of knowledge, rather activator and facilitator of learning (Fullan & Longworthy, 2013; Hattie, 2012; Vavrus et al., 2011).

In the same perspective, quality teaching fosters students' active participation in the process of teaching and learning; valuing their previous experiences, interests and motivations (Lange, 2016; Dean et al., 2012; Hattie, 2009). Active participation is a key to learning and improvement of students' competences (Fullan & Longworthy, 2014). Participation requires integration, contextualization and application of the acquired knowledge to different contexts and problems solving (Killen, 2009; Ehlers, 2013). In this orientation, quality teaching involves constructing meanings, criticizing, generalizing and finding possibilities of application of the knowledge acquired by students (Hattie, 2009 & Dean et al., 2012). Therefore, quality teaching can be understood as processes, in terms teacher' behaviors and actions, through which teacher activates and facilitates students' learning as regard to developing competences. In this perspective, quality teaching is more reflected in regard to what students do to get engaged in learning (Biggs, 1999: 63). The question is to ask which processes favor students' engagement and how competences are to be developed.

Despite the commonalities of quality teaching at different levels of education such participation, each has quality teaching aspects in alignment with its purpose in the overall education system. In the context of higher education, quality teaching is understood in regard to both purpose and nature of students. First, in relation to

purpose, higher education enhances understanding the nature and structure as well as creation of knowledge. From that angle, quality teaching is understood in terms of processes, through which students are actively engaged in processes and tasks that enhance higher order thinking (Biggs, 2011: 180).

Secondly, in relation to the nature of students, adults constitute the majority of university population (Dufitumukiza & Dusingizemungu, 2014; Nkundabatware & Niyibizi, 2014). Quality higher education takes into account andragogic principles of adult learning including self-directedness, relevance of the content, valuing experiences, task-centeredness (Knowles, Holton III & Swanson, 2005; Finn, 2011). Additionally, due to globalization and internationalization of higher education, the university student population is becoming more linguistically and culturally diverse (Biggs & Tang, 2011: 12-13). In this orientation, student-centered pedagogies are becoming prominent in the international discourse as means to improve quality higher education (British Council, 2014; Altbach et al., 2009; Hénard & Rosveare, 2012). Quality teaching in higher education can be then understood as processes that individually and collaboratively engage students in higher order reflection through different real life tasks, which enhance students' responsibility.

Despite the variety of quality teaching criteria among educational researchers, high cognitive activation by tasks, efficient classroom management, individual support, clarity and structure of the subject knowledge, good learning climate and feedback are discussed in research discourse (Creemers, Kyriakides & Antoniou, 2013; Brandenbourg & Wilson, 2013; Kanter et al., 2013; Creemers & Kyriakides,

2012; Dean et al., 2012; OECD, 2014; Scheerens, 2004; Gauthier & Démbelé, 2004; Hattie, 2009; 2012; Killen, 2009; NSW, 2003). To effectively influence learning, these criteria jointly and interactively influence learning (Kanter et al., 2013; Creeemers & Kyriakides, 2012). Without underestimating the contribution of other criteria of quality teaching, research shows that cognitive activation is important as regard to improving students' competences (Le Donné et al., 2016; Burge et al., 2015; Hattie, 2012).

Though the international discourse on educational research and practice is mainly about how to equip students with necessary competencies for successful employability and adaptability to cope with changing and challenging complex globalizing world, high cognitive activation by complex tasks is part of the solution, though not alone, to the concern.

2.2 High cognitive activation by complex tasks

In this section, I review some relevant literature on high cognitive activation by complex tasks. I respectively summarize what discourse reports about the concept of high cognitive activation, activating methods and complex tasks.

2.2.1 High cognitive activation

In the context of education, cognitive activation is embedded in constructivist approaches of learning (Snowman et al., 2009 & Killen, 2009). Constructivism as originated from scientific works of Swiss psychologists Jean Piaget (on individual constructivism) and Russian Levy Vygotsky about social constructivism, which regard learning as an individual process of creating meaning from her / his own

experiences (Bozkurt, 2017; Alsulami, 2016; Kurt, 2016; Kumari, 2014; Ertmer & Newby, 2013; Liu & Chen, 2010). Creation of knowledge occurs through reflection, which critically relates prior experiences and new knowledge in a given context individually or in interaction with the environment through mediation and social negotiation of meaning (Liu & Chen, 2010; Loarer, 1998). This is possible only when learning is situated in real life contexts for students (Ertmer & Newby 2013: 54). In the constructivist perspectives, the role of the teacher is to create conditions and set tasks, which would facilitate the process of creation of knowledge (Biggs & Tang, 2011& Bozkurt, 2017). Ertmer and Newby (2013) indicate that students have to be involved in "authentic tasks anchored in meaningful context" (p. 56). This means that constructivist teaching and learning process is active, interactive and reflective. Active participation reflects the principle of learning by doing whereby activity-physical or mental of the student is associated with effective learning (Dewey, 2011 & Killen, 2009).

Additionally, it relates to allowing opportunities to enhance metacognitive skills, sense of responsibility and autonomy. Interactivity refers to social constructivism of Levy Vygotsky where students co-construct meaning through social negotiation such as debate and discussion with teachers, parents, classmates and others (Bozkurt, 2017; Alsulami, 2016; Kurt, 2016; Ertmer & Newby, 2013). Reflectivity regards learning, which refers to reflection on own' experiences in light on newly acquired knowledge (Dewey, 2011 & Bourner, 2003). Constructivism is suitable for dealing with complex and ill-defined problems, which requires reflection on practice (Ertmer & Newby, 2013: 57). This proves its relevance to the topic under investigation

since cognitive activation by complex tasks engage students in reflective learning through challenging tasks.

Furthermore, the concept has its justification in the physiology of the brain. Brain is not static but dynamic in regard to learning (Hinton, Miyamoto, & Della-Chiesa, 2008; Kahveci & Selahatdin, 2007; Gülpinar, 2005; Brown, & Wheatley, 1995). In this framework, brain should be activated so as to reach abstract, logical and multivariate level of thinking called "formal operations" by Jean Piaget (Adey, 1999: 3). According to Jean Piaget, formal operations regard the last stage of cognitive development where the individual is able to generate and test hypotheses, weigh alternative sides of one argumentation or pros and cons of one course of action (ibid.). Pedagogically, high cognitive activation is embedded in the overall pedagogical movement of learner-centered education (Dean et al., 2012; Doyle, 2011). This pedagogy postulates that student has to take an active role in the process of teaching and learning (Biggs & Tang, 2011 & Killen, 2009). Effective active participation requires that teachers structure teaching methods, which can call engagement of students in the process of learning.

Literature shows that learning is effective when students are cognitively stimulated (Le Donné et al., 2016; Berge, et a., 2015; Fullan & Longworthy, 2014; Ehlers, 2013; Hattie, 2012; 2009; Baumert et al., 2010; Kanter et al., 2013; Adey, 1999). After persistence of rote learning leading to failure of understanding science related concepts, the intervention "Cognitive Acceleration through Science Education (CASE)" was introduced in United Kingdom and other parts of the world later (Adey, 1999: 35). Inspired by the cognitive development of Jean Piaget, CASE theory

was introduced. The CASE has five pillars namely concrete preparation, cognitive conflict, construction, metacognition, and bridging (Adey, 1999: 6). In this approach, clarity and understandability of the tasks are to be checked. Moreover, the tasks have to be challenging enough in the limits of the cognitive capacities of the students. Being challenging, the tasks engage students in the process of finding out the solution to the tasks –construction. In the process of construction students are allowed to find their best ways. CASE encourages students to evaluate their thinking towards solving the given tasks –metacognition and finally students are given opportunities to transfer the process of reasoning to other contexts. Findings from CASE and other initiatives of cognitive acceleration show positive results of students' achievements in sciences (Le Donné et al., 2016; Berge, et al., 2015; Adey, 1999). Moreover, cognitive activation increases students' competences in self-regulation and motivation important for effective learning.

In the process of teaching, cognitive activation regards strategies capable of cognitively challenging students, which motivate them to engage in higher order skills including critical thinking and problem solving (Le Donné et al., 2016; Berge, et al., 2015). Burge et al. (2015) indicates that cognitive activation encourages reflection on problems for an extended time. Students use their procedures to solve complex problems, which do not have single method of solution and / or with multiple solutions. Problems are given in different contexts and help students apply what they have learned to new contexts as well as learning from their mistatkes (p. 5). In this process, process-methods is the main focus (Burge, et al., 2015 & Barman & Konwar, 2011) and creative and alternative

ways of getting solutions to problems are encouraged (Le Donné et al., 2016: 6). Research conducted in nine OECD countries show that students whose teachers use cognitive activation strategies perform better in mathematics, have high level of motivation to learn, increase self-efficacy and self-concept toward mathematics (Le Donné et al., 2016 & Burge, et al., 2015). The findings are in line with the results of the meta-analyses conducted by John Hattie, which show that "challenge is the most important ingredient to effective learning" (Hattie, 2012: 57). Moreover, setting challenging tasks influence students' outcomes [effect size of 1.1] (Hattie, 2012: 33). From the above discussion, teaching without providing challenging tasks to engage students in deep learning would be alienating and inhibiting their aptitudes to get prepared for complex world they are being prepared. The question is which methods should be used to cognitively activate students to develop competencies.

2.2.2 Cognitive activation methods

Teaching as dynamic and creative process, research and practice do not show the exhaustive list of methods of cognitive activation. They depend on level, content and context of teaching (Biggs & Tang, 2011; Doyle, 2011). In the process of teaching, activation methods may have different functions namely sensitization, exploration and elaboration as well as problematisation and transfer (Scheunpflug & Schröck, 2003 cited in Krogull et al., 2014: 60).

Sensitization has the function of mobilizing students' previous knowledge about the topic in order to link it with their existing knowledge and experiences. Mobilization is important aspect of activation and motivation. Literature shows that effective learning relies on how teachers

acknowledge and provide students with opportunities to connect new content to previous learned topics and experiences (Dean et al., 2012 & Killem, 2009). Methods such as "brainstorming, picture associations, and mind maps, judging and justifying theses" (Krogull et al., 2014: 60) are important to make the new lesson meaningful, relevant and interesting. This leads to motivation and commitment, which are key to performance (Hattie, 2012; Biggs & Tang, 2007). Exploring and elaboration regard the process, through which students are engaged in investigation, hypothesisation and problem-solving (Krogull et al., 2014: 61-62). In this framework, students deepen their understanding and appropriation of the content. This is possible through investigating its different perspectives through research, solving problems, experimental inquiry; analyzing related texts, debating as well as inventing methods of representation of the content such as posters or wall newspapers as means of representation, reflection and application of the content (Senn & Marzano, 2015; Krogull et al., 2014; Dean et al., 2012). Students can get engaged in exploration and elaboration individually or in group referring to cooperative learning (Dean et al., 2012 & Killen, 2009). Literature shows that activating methods requiring exploration and elaboration such as problem-solving and cooperative learning, analysis, concept mapping are important for effective learning (Hattie, 2012; 2009 & Krogull et al., 2014). Such activating methods are keys to deep learning where students are engaged in the process of searching the meaning of the content (Hattie, 2012; Biggs & Tang, 2011).

Since students are prepared for being useful in the society, effective teaching should provide opportunities for them to reflect on how the acquired knowledge is transferable in

day-to-day and professional life. Activating methods for problematisation and transfer (Krogull et al., 2014: 62) are important for this end. Simulations such as debate and conference game requiring decision making are important to stimulate students' reflection about possibilities of transferability of the content in different contexts (Senn & Marzano, 2015; Krogull et al., 2014). Among other cognitively activating methods, complex tasks are driving force for effective learning process and students' achievements in terms of learning outcomes (Ehlers, 2013; Kanter et al., 2013; Hattie, 2012).

It can be seen from the above literature that cognitive activation requires involving students in different tasks. The latter can have different levels of activation. The higher the activating tasks, the challenging and higher learning are likely to occur. Among different methods of activation, complex tasks are important for improving students' competences, when effectively used. In the following part, I propose a review of what research discourse says about complex tasks.

2.2.3 Complex tasks

No single definition can capture the holistic meaning of complex task. However, characterizing complex task is one way to understand how it looks like. Apart from features of complex task, task-based methodology is discussed hereunder.

Characteristics of complex task

The term complex task is given different nominations from different perspectives. They may include but not limited to stimulating, challenging, demanding, learning,

authentic, deep learning tasks (Hattie, 2012; Fullan & Longworthy, 2014). Though the above terms can be used interchangeably, complex task is preferred in the study at hand due to not only consistency but also the word "complex", which reflects complex processes, through which a task is to be performed. In the context of teaching and this thesis, describing features of a complex task helps to understand what makes a task complex. Without disregarding other perspectives, three characteristics of complex task can be identified: real-life relevance, level of competences and responsible work of students.

First, complex task should be related to real and lived context of students (Le Donné et al., 2016; Burge, et al., 2015; Paas, Merrienboer & Gog, 2011; Herrington, 2009; Lombardi, 2007; Merrill, 2007; Ruixue, 2006; Spering, 2005; Skehan, 2003; Merriënboer, Clack & De Croock, 2002; Enright, Oltman & Philip, 1996). This means that designing complex tasks should take into consideration the context of students. The context may be related to students' past and current day-to-day or professional experiences. The feature eases the authenticity of learning, which brings meaningfulness and relevance to learning process (Lombardi, 2007). The real-life relevance of the task enhances motivation and interest, which are important for effective learning process (Le Donné et al., 2016; Burge, et al., 2015 & Woolfolk, 2013).

Second, complex task has to address different levels of competencies (Merrill, 2006: 5). This is the most important feature reflecting the complexity of task. Complex tasks are designed in such a way that they allow multiplicity of outcomes recalling diversity of solution pathways (Mazmann & Altum, 2012; Herrington, 2009; Merrill, 2007;

Enright, et al., 1996). In this framework, complex task is characterized by the complexity of real-world situation requiring interconnectivity of variables (Merrill, 2007: 33). Additionally, students are committedly engaged in reflective investigation whereby integration and coordination of knowledge within (intra-subjectivity) or between subjects (inter-subjectivity) are a necessity (Herrington, 2009; Le Donné et al., 2016; Ronen & Langley, 2004; Merriënboer, Clack & De Croock, 2002). To perform complex tasks requires a lower- remembering, application and higher complexity cognitive processes including but not limited to critical thinking, decision making, problem solving, inventing, creating (Senn & Marzano, 2015; Marzano & Kendall, 2007). The process addresses at the same time different levels of competences (Krogull et al., 2014: 59). Sometimes, one complex task requires performing different sub-tasks reflecting a variety of levels of competencies needed to be developed.

In this framework, what makes a task complex is the level of challenging resulting from the interconnectivity of knowledge, pathways and processes. The process of interlinking different sort of knowledge within or between subjects requires a variety and higher mental processes such as critical thinking, decision making and problem solving (Le Donné et al., 2016; Burge, et al., 2015; Senn & Marzano, 2015; Merrill, 2006). Merrill (2006) shows that this requires students' capacity to critically and reflectively demonstrate and apply acquired knowledge in connection with previous experiences. Therefore, complex tasks require demonstration, application and reflection of the acquired knowledge (pp. 11-19).

Third, complex tasks require the active and responsible engagement of students. As complex tasks allow competing diversity of perspectives and solutions, they provide students with responsibility and autonomy to choose perspective(s), through which the task is to be performed (Le Donné et al., 2016; Burge, et al., 2015; Herrington, 2009). The same responsibility and autonomy are not limited to choosing pathways but also to the process of monitoring and communicating the choice about how they got the solutions to others (Le donné et al., 2016: 6). Complex tasks may take different orientations and forms depending on the level of education, content and context (Merrill, 2007: 33). It may include but not limited to producing a given product or solve problems (Merrill, 2006: 25). Students may be asked to design or produce something-inventing (Senn & Marzano, 2015: 81). In the context of higher education, students may be asked to produce an academic writing like seminar paper, newspapers, marketing publicity, reflective portfolio, class discussions and video analysis (Niyikiza, 2014; Kanter et al., 2013). With regard to problem solving, students may be asked to solve mathematical real-life problems (Le Donné et al., 2016; Burge et al, 2015; Adey, 1999). Additionally, complex tasks may be related to investigation where students are engaged in research; decision making, experimentation and designing tasks, which require students to generate or test hypotheses (Senn & Marzano, 2015; Merrill, 2007; Burge et al., 2015). In the practice of teaching and learning process, complex task may take the form of debates, problem solving, portfolio, research, project work, critical text analysis and writing (Krogull et al., 2014: 62-68). This means that complex tasks are sorts of tasks, which are challenging, real life relevant and

capable of cognitively stimulating students' deep reflective thinking. The question should be how to methodologically use complex tasks in the practice of teaching and learning.

Methodology of complex task-based instruction

Research discourse shows different approaches of task-based pedagogy. The first approach is task-based teaching / methodology, which has been mainly debated in the language acquisition teaching (Skehan, 2003; Willis, 1996). The second approach is task-centered instruction, which put emphasis on centrality of real-world complex tasks as the heart of quality teaching (Merrill, 2007: 33). The two approaches have the centrality of real life complex task as important in the process of teaching and learning. Observations made show that two teaching approaches are embedded in direct instruction due to directiveness, focus on understanding and progression from simple to complex (Merrrill, 2007; Gauthier & Dembélé, 2004; Skehan, 2003).

Gauthier and Dembélé (2004: 9) indicate another emerging approach of teaching- discovery-based teaching, which focuses on construction and interactivity of knowledge through investigation recalling critical thinking and problem solving. Two teaching approaches inspire the researcher in discursively describing task-based methodology. In the study at hand, complex tasks are not only those whose models are given but also those, which require creativity and capacity to critically and reflectively apply and integrate acquired knowledge in real life contexts. In any teaching, planning and assessment are important to be considered. Therefore, planning and implementation of complex task-based instruction are described hereunder.

First, planning a complex task-based instruction requires designing tasks in relation to content (Guiyu & Yi, 2017; Kanter et al., 2013; Skehan, 2003; Merrill, 2002. Additionally, designed task should, as discussed earlier, fulfill features of complex tasks such as real life relevance, complexity and responsibility (Le Donné et al., 2016; Burge et al., 2015; Mazmann & Altum, 2012; Herrington, 2009; Merrill, 2007; Enright, et al., 1996). Since different tasks are to be used during teaching, a variety of tasks are designed with different levels of complexity (Merrill, 2007). The same author shows that tasks need to clearly show givens and what students are to do in a given task as well as proposing an illustration of the answer. The approach is too directive especially on the aspect of illustrating the solution. This may inhibit students' responsibility and creativity. Since complex tasks allow students a multiplicity of pathways and solutions, this aspect has to be minimized. In this regard, effective planning is predictor of successful task-based instruction (Wang, 2008: 83-85). Timely and reflective planning is important for the success of complex task-based methodology.

Second, three interrelated phases of task-based /centered teaching are proposed (Merrill, 2007 & Willis, 1996). They are pre-task, during task and post-task. The phase of pre-task includes all activities carried for the preparation of task performance by both teacher and students. Teacher motivates students by explaining the importance of the task, provides a model task for them and students do the model task under the guidance of the teacher. In the second phase, students are actively engaged in task performance in a specified time by autonomously applying strategies used in the model task. As mentioned earlier, surprises and new aspects are added to subsequent tasks to the

model one to stimulate students' creativity both in regard to content and processes (Senn & Marzano, 2015 & Skehan, 2003). In the third phase, students are asked to repeat the same task individually, in group or publically; reflect on how the task was performed as part of self-assessment.

Though the aforementioned model can inspire teachers in planning and implementing complex task-based teaching, I find two limitations practitioners should be aware: over-directiveness and closeness of the model. The world to which students are being prepared is too complex and requires competences such as creativity, research, autonomy, responsibility (Senn & Marzano, 2015 & OECD, 2014). No solution can fit all problems. Flexibility in searching context-related creative solutions is a master for being successful in the 21st century. With this regard, over-emphasis on directiveness through models to be imitated by students is to be minimized. This does not mean that students have to be sent in the unknown without guidance. Directions should be given with enough room for enhancing students' responsibility and creativity by letting students decide, which ways to perform a task.

The model described above only gives an inspiration on how task-based instruction is to be organized. However, use of complex tasks in teaching is very complex. The model only shows how teachers should teach how to solve complex tasks with limited indication of how to learn through complex tasks. For example, this model does not precise how assessment is to take place and yet it is an important aspect of quality teaching (Reeves, 2006; Biggs & Tang, 2011). Another critic is that complex tasks can be used at different levels of lesson development not only as specific task lesson. As cognitive activation by complex

tasks is known from research to be a driving force for quality teaching (Kanter et al., 2013; Hattie, 2009), I review the literature about how the concept is related to teaching quality.

2.3 High cognitive activation by complex tasks and quality teaching

As indicated in previous parts (2.1.1, 2.1.2), quality teaching is at the heart of the overall educational quality improvement and cognitive activation by complex tasks is a powerful driving force in achieving quality teaching in terms of students' competencies (Le Donné et al., 2016; UNESCO, 2014). In the following sub-chapter, I review literature on the contribution of high cognitive activation by complex tasks to teaching and learning process, development of competencies and teaching at higher education.

2.3.1 Cognitive activation by complex tasks and teaching-learning process

Using cognitively activating complex tasks in teaching and learning process is important in a number of ways. Hattie (2012 & 2009) shows that effective teaching is the one which challenges students. Additionally, he shows that setting challenging tasks and engaging students in problem solving (with respective effect sizes of 1.1 and .9) highly influence students' achievement. In this part, I discursively describe how high cognitive activation by complex tasks enhance active participation, motivation, interest, self-efficacy and self-concept, deep understanding; collaboration and metacognition important for effective teaching-learning process.

Literature shows that effective learning takes place only

if students are actively engaged (Lange, 2016; Woolfolk; 2013; Roggers & Horrocks, 2010 & Killen, 2009). In this framework, cognitively activating complex tasks are powerful driving tools for active participation (Kanter et al., 2013 & Ehlers, 2013). This is materialized through deep reflection on pathways to perform the task by critically interconnecting previous experiences and new acquired knowledge in the context specified in the same task (Le donné et al., 2015 & Kunter et al., 2013). Additionally, cognitive activation by complex tasks enhances students' motivation and intrinsic motivation among students (MaCaslin & Good, 1996; Turner, 1997 cited in Woolfolk, 2013). Motivation and interest, positive self-efficacy and self-concept are important ingredient for effective learning (Krogull et al., 2014; Hattie, 2012; 2009). Literature shows that engaging students in cognitively activating complex tasks increase their motivation to learn, self-efficacy and self-concept about mathematics (Le Donné et al., 2016; Burge et al., 2015). Additionally, students are interested in complex tasks in English language, which improves their linguistic competences (Jiang, 2010& Ruixue, 2006).

With regard to learning process, literature shows that cognitive activation by complex tasks is a tool for developing deep understanding of the content in different contexts (Kanter et al., 2013; Hattie, 2012). Through cognitively activating complex tasks, students are engaged in mental processes requiring intelligent manipulation of content such as "modification, expansion, interlinking, restructuring, rebuilding" (Kanter et al., 2013, p. 101), creating meaning, criticizing, generating and testing hypotheses and finding new applications of the content in new situations using creative alternatives (Le Donné et aL., 2016; Senn & Marzano, 2015; Hattie, 2012). This is

possible only if students can link previous experiences and knowledge with new content within or between subjects (Merrill, 2007 & Kunter et al., 2013). As indicated by Hattie 2009) and Dean et al. (2012) that effective teaching values previous experiences of students, cognitive activation by complex tasks serves for this end (Kanter et al., 2013 & Merrill, 2006). This facilitates the application, integration and transferability of the content in new situations (Merrill, 2007: 34).

With regard to students' performance, literature indicates that effective use of cognitively activating complex tasks improves students' performance (Tangyong, Wahyudi, Gardner & Hawes (1989) as cited in Lange, 2016; Hattie, 2012). Empirical studies conducted in UK shows that cognitive activation is closely linked to higher performance of students in sciences and mathematics (Le Donné et al., 2016; Burge et al, 2015; Kanter et al., 2013; Adey, 1996). Additionally, complex tasks are associated with effective learning of vocabulary language (Sarani & Sahebi, 2012: 124-125).

In addition to the role of cognitive activation by complex tasks in increasing active participation and enhancing deep understanding and transfer of knowledge, research shows that through allowing students to responsibly and autonomously choose pathways to perform tasks improves their metacognitive strategies (Le Donné et al., 2016; Burge et al., 2015; Woolfolk, 2013). In the meta-analysis of Hattie (2009), meta-cognitive skills have high effect size (.69) in regard to influencing learning (Hattie, 2012: 251). Therefore, cognitive activation by complex tasks is important tool for improving learning as it relates to meta-cognitive skills, driving force for students' achievements.

In views of social constructivism, encouragement of collaboration and cooperation among students is a key ingredient for effective learning (Bozkurt, 2017; Alsulami, 2016; Kurt, 2016; Ertmer & Newby, 2013). Since students are provided with challenging tasks, they mostly get engaged in collaboration and cooperation to successfully perform the given stimulating tasks. Empirical literature indicates that cognitively activating complex tasks increase collaboration and cooperation among students (Le Donné et al., 2016; Burge et al., 2015; Kanter et al., 2013). Cognitively activating methods serve as instrument energizing mutual collaboration and cooperation among students.

Drawing from the above discussion, it is visible that high cognitive active activation by complex tasks serves the process of teaching and learning. Though I separated them, process and outcome are always linked. The following sub-section describes how high cognitive activation by complex tasks is related to competency-based education.

2.3.2 Cognitive activation by complex tasks and competency-based education

As it was shown earlier (chapter 1), high cognitive activation by complex tasks is embedded in the competency-based education. I first conceptualize competency-based education. Additionally, I explain how cognitive activation by complex tasks is related to development of competences in teaching and learning process.

Conceptualizing competency-based education

Since the beginning of the second half of the 20th century, both theory and practice have been debating about the

concept of competency to improve education (Hodge, 2007: 180-181). Though it has been defined in different perspectives, competency means the ability to integrate and apply knowledge, skills and attitudes to solve problems or do given tasks in a specific context (Ehlers, 2013; Barman, 2011). Competency implies different aspects. First, competency requires combination of cognitive, socio-affective and psychomotor skills in a way that that knowledge, skills, interests, attitudes, and values are blended to allow an individual to solve problems or do any tasks (Hoogveld, 2003: 8). Second, competency is activity-oriented. Individual is judged competent if she / he is able to use acquired knowledge in combination with other personal or acquired skills to perform a given tasks (Abykanova et al., 2016). Third, competency is context-bound. Since contexts are always different, competency is not fixed but requires flexibility to transfer acquired knowledge to different contexts.

Literature shows that competences are necessary to cope with the complex changing and globalizing world in the 21st century. They include cognitive competences (critical thinking, creativity, problem-solving, analysis, reading, decision making), intrapersonal (metacognitive, responsibility, autonomy, flexibility, and adaptability) and interpersonal (communication, teamwork and collaboration) are important (Binkley, et al., 2012; National Research Council, 2012). Each of the competencies can be described at different levels of which teachers should be aware (Krogull et al., 2014: 76). Though levels of competencies are complex, OECD shows levels of competencies to be assessed in PISA reading, science and maths for 15 years old students in countries members of OECD. For example, reading competency is subdivided

into three subscales from the lowest to the highest as accessing and retrieving; integrating and interpreting as well as reflecting and evaluating texts (OECD, 2014: 191). In the context of professional fields, students are classified according to the level of performance as novices, advanced, competent, proficient and expert (Khan& Ramachandran, 2012: 921-926).

In the framework of education, competency-based teaching fosters the development of competencies through acquisition and application of knowledge to solve problems in real-life contexts (Krogull et al., 2014: 55). In this perspective, teacher serves as activator and facilitator not the source of knowledge (Fullan & Longwothy, 2013; Hattie, 2012). Additionally, competency-based education put emphasis on application of knowledge, centrality of the learner and learning process, development of generic competences and competency-based assessment (Barman & Konwar, 2011: 11). In this framework, the determination of learning outcomes guides all teaching and learning activities (Biggs & Tang, 2011). As mentioned earlier (2.1.2), among other aspects being also important, cognitive activation by complex tasks is closely linked to competencies (Ehlers, 2013; Kanter et al., 2013; Hattie, 2012). The following discursively describes how competencies are developed.

Cognitively activating tasks and development of competencies

In the ever-increasing complexity of modernizing society, the utmost goal of education is to equip students with necessary competences. Additionally, lifelong learning skills (Biggs & Tang, 2011: 8) are an added value for meeting requirements of the 21st century. In the context of

higher education, emphasis is to be put on the development of generic social and personal competencies as well as enhancement of lifelong skills to cope with economic growth in the globalized and internationalized society (National Research Council, 2012 & Stern & Wagner, 1999). In this framework, teaching has to be organized and practiced in such a way that competencies are developed.

Competencies can be developed explicitly or implicitly among students. In both conditions, competencies are developed when students perform cognitively activating and real-life complex tasks (Krogull et al., 2014; Ehlers, 2013). Ehlers (2013) argues that development of competencies relies on personal active engagement of students in higher order thinking such as critical thinking and reflection accompanied with social and emotional orientation towards the content or tasks (pp. 52-62). Additionally, he indicates that competencies are enhanced among students when knowledge and skills meet complex tasks related to real life contexts. This implies that action, reflection, application, transferability and context are important for development of competencies. This reflects the principle of “learning by doing” developed by Dewey, an American philosopher who advocates for learning through action-reflection (Dewey, 2011 & Rogers, 2002). To effectively develop competencies, the practical application of knowledge in different context through complex tasks is accompanied by motivation and capacity to reflect on one’s own actions in relation to established standards (Ehlers, 2013; Merrill, 2007).

The development of competencies is very complex. It results from critical and reflective combination of cognitive, meta-cognitive, social and emotional skills through performing cognitively activating complex tasks.

This means that apart from designing tasks, which are cognitively activating, other aspects are to be considered to effectively engage students in the process of developing competences.

As the focus of the present thesis is higher education, in the following sub-section, I explain, how cognitive activation by complex tasks is important for quality teaching in higher education (2.3.3).

2.3.3 Cognitive activation by complex tasks and quality teaching in higher education

The university students are mainly adults. Adult learning is different from children and teenagers (Knowles; Holton III & Swanson, 2005). In this regard, university teaching practice should take into consideration the above differentiation. In this section, I discursively explain how cognitive activation by complex task is related to adult learning and teaching at higher education.

Cognitive activation by complex task and adult learning

Literature on adult education indicates six principles underlying adult learning: self-directedness, valued experience, relevancy orientation, task-centeredness, purpose-oriented learning, and motivation (Kadir, 2016; Falasca, 2011; Finn, 2011; Gregson, 2007; Knowles, Holton III & Swanson, 2005; Moore, 2005; Huang, 2002; Merriam, 2001). Despite some minor specificities for adult learning, two of the principles (purpose-oriented learning and motivation) are generally common for all levels and types of education. For the purpose of this study, four are discussed as regard to how they are related to cognitive activation by complex tasks. They are self-directedness,

valued experience, relevancy orientation, and task-centeredness.

First, adults need to feel autonomous and responsible in their learning (Falasca, 2011; Finn, 2011; Gregson, 2007; Knowles, Holton III & Swanson, 2005). Adults have the self-concept of being responsible to decide for their own life and learning (Knowles, Holton III & Swanson, 2005). When cognitively activating complex tasks are used, they respond the self-directedness of adults. As complex tasks offer multiplicity of answers and pathways (Le Donné et al.; 2016; Burge et al., 2015), adult students feel more autonomous and self-responsible when performing complex tasks. Second, adult students come to school having accumulated huge experiences, which need to be valued during teaching and learning process (Falasca; 2011; Gregson; 2007). Cognitive activation requires students to mobilize different sources of knowledge and experiences (Merrill, 2007: 35). Additionally, Knowles et al. (2005) indicate methods to activate previous experiences, which include group discussion, debate, simulation exercises, problem solving, case and laboratory methods (p. 66). If cognitively activating complex tasks mobilize previous knowledge and experience, it is likely to be useful for adult learning process.

Third, effective adult learning takes place when teaching and learning process is meaningful (Knowles et al., 2012 & 2005). The author shows that things being learnt should be embedded in real life situations. One of irreplaceable feature, which makes a task complex is real-world relevance (2.2.3). This means that using cognitively activating complex tasks satisfy adult learning needs in regard to contextualization of teaching. In this perspective,

Freire (2005) advocates for problem posing education, which allow students opportunities to reflect the practice through contextualized tasks (pp. 80-85). Four, adult learning is "task-centered or problem-centered" (Knowles et al., 2005, p. 67). Effective adult teaching engages adult students in performing tasks designed to enhance critical and reflective application of knowledge in real-life situations (Finn, 2011; Falasaca, 2011; Knowles et al., 2005). Cognitively activating methods especially complex tasks respond to the principle of adult learning related to engaging adult students in real life complex tasks.

2.3.4 Cognitive activation by complex tasks and teaching in higher education

The Bologna process was not only introduced as an administrative benchmarking for internationalizing higher education in regard to students' mobility and transparency among systems (Altbach et al., 2009:xi). It rather enhances quality teaching in regard to shift from teacher-focused to student-centered teaching (HEC, 2007b: 2). There is shift of emphasis from what teacher does to what student does-learning process. In this framework, the role of the teacher is to prepare and create conditions enabling students actively engaged so as to achieve intended learning outcomes. This helps students to get necessary competences for 21st century, which are more complex (Biggs & Tang, 2011 & Biggs, 2001; 1999).

Higher education has two interlinked and interdependent mission: teaching and research (Teferra & Altbach, 2004: 27). Teaching at university mainly focuses on deep understanding knowledge from different perspective and transfers it to different real life contexts. The kind of teaching is only possible if students are engaged in higher

cognitive processes including but not limited to interlinking, applying, generate hypotheses, problem solving (Biggs, 2001 & 1999). The author argues that quality teaching is the one that engages students in higher order thinking such as critical thinking, problem solving and decision-making. This means that university teaching practice is to look differently. It has to be more constructivism oriented. Current research shows that university focus on research in favor to teaching has been replaced by reconsideration of teaching (Helliwell, 2008: 4). Additionally, researchers reflect on how to integrate research in order to improve teaching (Biggs & Tang, 2011: 9). Research itself is complex. To effectively develop research skills cannot be done using behaviorist approach of learning. Rather, higher order thinking skills including critical thinking, problem solving, decision making, investigation, and analysis are useful for the context of higher education teaching requirements.

Considering the requirements of university teaching and features of cognitive activation by complex tasks; my analysis shows that the latter is a tool for improving quality teaching at higher education. The fact is that cognitive activation by complex tasks aims at developing higher order thinking (Le Donné et al., 2016; Burge et al., 2015) which is the core foci of the university (Biggs & Tang, 2011; Altbach et al., 2009). Students can develop higher cognitive processes only if they are engaged in cognitively challenging tasks (Senn & Marzano, 2015; Marzano & Kendall, 2007). Therefore, cognitively activating complex tasks are important tools to enhancing teaching quality at higher education in regard to knowledge understanding, creation and transfer as well as research competences.

Though cognitive activation by complex task is scientifically recognized to be important tool for improving the process

and outcome of teaching and learning, there are other considerations, which need to be taken into consideration. The following describes collaborators of high cognitive activation by complex tasks in improving students' achievements.

2.3.5 Success factors for cognitive activation by complex tasks

In the context of the present study, high cognitive activation by complex tasks is important for improving educational quality. However, it is not alone. As already indicated (2.1.2), high cognitive activation by complex tasks is one of the criteria of quality teaching, which are closely interconnected. Success factors for high cognitive activation by complex tasks cannot be identified far from factors influencing the whole process of teaching and learning. Though teaching is influenced by complexity of factors, as inspired by Biggs & Tang (2011), Hattie (2009), Reeves (2006) and Rust (2002), factors influencing high cognitive activation by complex tasks are analyzed in perspectives of student, teacher, environment (home, school and classroom), curriculum, teaching and assessment.

If the high cognitive activation by complex tasks is to succeed, conceptions of teaching, learning role of both student and teacher have to be embedded in constructivist approaches of learning. Students become their own teachers (Hattie, 2012: 5). Teacher becomes both activator and facilitator of learning process (Fullan & Longwothy, 2014; Hattie, 2012).

In cognitive aspects, previous knowledge and experiences are important for getting engaged in cognitively complex

tasks (Krogull et al., 2014; Hattie, 2009). Performing complex tasks requires effort on the side of students. In this orientation, motivation and self-concept are key to get engaged in cognitively activating complex tasks (Krogull et al., 2014; Hattie, 2009). Conducive environment in terms of efficient classroom management, positive relationships among students as well as good learning climate influence learning in general and particularly cognitive activation by complex tasks (Le Donné et al., 2016; Burge et al., 2015; Kanter et al., 2013; Hattie, 2009).

So far as teacher related factors are concerned, subject knowledge, general pedagogical, and subject didactical skills as well as positive relationships with students are necessary to positively influence learning (Kanter et al., 2013; Hattie, 2009; Gauthier & Démbelé, 2004). Specifically, knowledge of complex tasks, competences to develop them and well as related specific methodology are important for successful use of cognitive activation by complex tasks (Hooveld, 2003; Merrill, 2007; Skehan, 2003). Additionally, empirical findings show that constructivist beliefs, self-efficacy and cooperation among teachers are driving force for successful use of cognitive activation by complex tasks (Le Donné et al., 2016: 13). Cognitive activation by complex tasks is possible only if the curricula offer flexibility and responsibility to teachers and put reasonable balance between surface and deep learning (Hattie, 2012: 15). It is not easy to use complex tasks if the curriculum is embedded in behaviorist approach where students are to merely learn by memorization. Reading is the mother of other competences (OECD, 2014; UNESCO, 2004). In this regard, curricula that foster reading (Hattie, 2012: 65) are likely to facilitate cognitive activation by complex tasks. With regard to teaching, other criteria of quality teaching as

indicated in 2.1.2 are valuable for the success of cognitive activation by complex tasks. For example, Le Donné et al. (2016) Burge et al. (2015) and Kanter et al. (2013) indicated that individual support is important for the success of cognitive activation by complex tasks. In the same vein of ideas, constructive feedback is scientifically recognized as powerful factor of learning (Hattie, 2012; 2009; Dean et al., 2012). To be successful, mistakes are not to be avoided but are welcome as useful learning resources (Krogull et al, 2014: 46; Hattie, 2012: 71). All students make mistakes especially when engaged in complex tasks (Hattie, 2012). In this framework, providing constructive feedback is regarded as one of keys to success for high cognitive activation by complex tasks (Hattie, 2012: 115-134).

Another important factor is assessment. The way the assessment is set determines the degree of effort students deploy in learning (Reeves, 2006; Rust, 2002; Biggs, 2001). Students cannot get actively engaged in teaching and learning process if reproduction-oriented assessment is still used (Reeves, 2006: 299-300). This means, as Biggs argues in his publications, that assessment should be aligned with learning outcomes (Biggs & Tang, 2011; Biggs, 2001; 1999). Assessment inhibits students' engagement if it is not aligned with learning outcomes (Rust, 2002 & Biggs, 2001). Therefore, to be successful, cognitively activating complex tasks are to be used during both teaching and learning as well as assessment.

2.4 Challenges of cognitive activation by complex tasks

Adopting and using high ognitive activation by complex tasks are important in improving educational quality but face a number of challenges (Le Donné et al., 2016; Burge et al., 2015; Senn & Marzano, 2015; Hoogveld, 2003). In

the thesis at hand, two perspectives are adopted to analyze of challenges of cognitive activation by complex tasks. Firstly, direct challenges related to the implementation of cognitive activation by complex tasks are described in relation to planning, implementation and assessment. Indirect challenges are explained in regard to other threats hampering teaching and learning in the context of Sub-Saharan Africa. Teachers and other educational stakeholders should be aware of the challenges and reflectively find mitigation measures.

So far as planning is concerned, Hoogveld (2003) found that that it is not always easy for teachers to develop cognitively activating complex tasks (pp. 101-102). This regards the failure to design tasks linked to real-life of students, addressing different levels of performance and engaging responsibility of students. One of the mistakes is to design tasks related to context of students but unchallenging and require students to only reproduce acquired knowledge without reflection (Senn & Marzano, 2015: 11). Moreover, the author indicates that the implementation of using cognitively activating complex tasks is limited by teachers' beliefs about students especially their abilities to perform cognitively challenging tasks (ibib: 11, 24, 38, 53, 85, & 101). For example the author shows that some teachers fail to release responsibility to students to think alternatively and generate hypotheses. Rather they impose strategies and procedures to solve problems. This can happen because of the lack and / or limited of knowledge of and competencies to develop cognitively activating complex tasks. Additionally, literature shows that cognitive activation by complex tasks is time consuming on the side of teachers (Le Donné et al., 2016: 14). Designing cognitively activating complex tasks may require additional time for preparing teaching.

In the process of implementation, sometimes teachers fail to release responsibility to students. Support can be provided without compromising the cognitive engagement of students through showing strategies to perform the tasks. Using cognitively complex tasks can be challenged by behaviorist rote memorization materialized by domination of the teacher. Though tasks might be complex, over-guidance inhibits students from enhancing their creativity, reflection and capacity to investigate for enhancing their competencies. Additionally, providing constructive feedback in the context of cognitive activation by complex tasks is not always easy for teachers (Ibid.). As indicated earlier (2.2.3), students have to creatively look for multiple pathways and solutions to perform the tasks. It requires higher level of content knowledge, analysis skills on the side of the teacher.

The implementation of cognitively activating complex tasks cannot be successful if students are not dedicated to perform given tasks. Cognitive activation by complex tasks recalls commitment and efforts on the side of students. Sometimes, students lazily work on tasks and produce non-evidenced results (Ibid. p. 12). Additionally, the participation of all students can be crucial. In group work, bright students work on tasks alone and submit as group work (ibid.). Additionally, cognitive activation by complex tasks may be challenged by lack of metacognitive knowledge and strategies, which are necessary for complex tasks (Mazman & Altun, 2012: 23). It would be a great challenge if students do know how to take control over their learning. As shown above (2.2.4), assessment is the determinant in increasing engagement of students. Behaviorism-oriented examination may inhibit students' commitment to performing cognitively complex tasks

(Reeves, 2004: 299). Students prefer study strategies in relation to assessment orientation (Mugisha, 2010: 105). If rote memorization is preferred in examinations, students would find hard to interestingly get engaged in cognitively activating complex tasks.

In the context of Sub-Saharan Africa, higher education faces numerous challenges hampering the educational quality (Altbach et al., 2009; Teferra & Altbach, 2004). My analysis here focuses on inputs and processes. So far as input is concerned, higher education in Sub-Saharan Africa face a challenging shortage of teaching staff (Hayward & Ncayiyana, 2014; Teferra & Altbach, 2004). In addition to shortage of qualified and pedagogically trained teaching staff, universities in SSA Africa likewise are confronted to limited infrastructures and facilities (Teferra, 2004: 46). The implementation of high cognitive activation might be challenged by limited facilities such as reading materials.

In the process of teaching, literature shows that rote learning dominates the practice of higher education in SSA (British Council, 2014; Altbach et al., 2009). This can be a serious barrier for the implementation of cognitive activation by complex tasks. Additionally, the media of instruction in most universities in Africa are international languages- French or English sometimes not mastered by both teachers and students (Teferra & Altbach, 2004: 45). This can be a serious barrier for implementation of cognitive activation by complex tasks since tasks are given and performed in the medium of instruction. In addition to language, oral tradition still dominates Africa in general and impacts on reading and writing skills of students in higher education. Low level of reading capacity may obviously hamper the implementation of cognitive

activation by complex tasks since students need critical reading capacities to understand and perform the tasks. The initiation and implementation of cognitive activation by complex tasks in the context of SSA higher education need to be aware and reflect on the challenges and creatively find related strategies to overcome them.

2.5 Mitigation strategies

To overcome challenges related to the use of cognitive activation by complex tasks in higher education, different strategies are proposed (Le Donné et al., 2016; Burge et al., 2015; Senn & Marzano, 2015). With regard to knowledge of and competences to design cognitively activating complex tasks, researches show that professional development in forms of continuous in-service training and professional learning communities among teachers are important (Le Donné et al., 2016, Adey, 1999; Loarer, 1996). Through effective in-service teacher training, teachers acquire knowledge and develop competences, which can be useful for implementing cognitive activation by complex tasks. Additionally, professional learning communities among teachers within or between educational institutions would facilitate the quality of cognitive activation by complex tasks (Le Donné et al., 2016; Adey, 1996). So far as planning is concerned, teachers should be allowed time for preparation counted in their official workload (Le Donné et al., 2016: 14). This might enable them reflect deeply on the tasks they have to provide to students. To support students effectively engage in cognitively activating complex tasks, students should be trained on study skills such as critical thinking and reading strategies as well as metacognitive strategies (Mazman & Altun, 2012). Hattie (2009) shows that study skills and meta-cognitive strategies influence

learning (Hattie, 2012: 251). With this regard, teachers have responsibility to train and engage students in tasks that recall them to take control over their learning. In this framework, constructive feedback is not provided on performance of tasks but also on self-regulatory strategies use to perform the same tasks (Hattie, 2012).

So far as assessment is concerned, aligning assessment with learning outcomes and teaching methods is a solution to enhance and encourage students to get actively engaged in cognitively activating complex tasks (Reeves, 2006; Rust, 2002; Biggs, 1999). If students are to develop higher order thinking skills, evaluation has to be designed in order to assess their competencies (Biggs & Tang, 2011: 9). This means that assessment is to be complex itself to enhance complex learning.

In the context of higher education where teaching staff and students face the limitations of language coupled with low reading skills, strategies are to be identified in university education systems. Though universities have to support students in regard to enhance academic language (Arendale, 2014; Griffin, 2014; Foster, 2002), the challenge is to be reflected at previous levels of education. The reason is that students are to understand academic language important for complex learning at university (Arendale, 2014: 2). However, if students are still struggling with lower linguistic skills, their academic integration will be problematic. Additionally, language courses are important for newly recruited students (Griffin, 2014: 7). In coping with linguistic challenges, which hamper students' understanding, mixture of language is adopted in teaching (Kagwesage, 2013: 9).

2.6 Cognitive activation by complex tasks in Sub-Saharan African higher education

In the following section, the available literature on higher education didactics is critically reviewed with focus on SSA and particularly Rwandan higher education.

Enhancing quality higher education in Sub-Saharan Africa is considered as one of the strategic measures to boost social and economic development in the modernizing and globalizing world (WB, 2009: ix). With this perspective, the SSA higher education system knew huge quantitative increase since 20th century (British Council, 2014 & Teferra & Altbach, 2004). However, the same system faces many challenges in regard to input and process, which hampers the quality of workforce produced by the university industry in Africa (British council, 2014; Altback et al., 2009; WB, 2009; Teferra & Altback, 2004). On the input side, the SSA higher suffers insufficiency of qualified faculty, infrastructure and other facilities (Teferra & Altbach, 2004). On the process side, transmission-led pedagogies are still dominating in SSA universities (British Council, 2014). Since the beginning of the 20th century, higher education in SSA started adopting the Bologna process through modular system for the purpose of internationalization. The Bologna process influence overall reforms in Sub-Saharan African higher education in terms of governance, research and teaching (Saint, Lao & Materu, 2009; Khelfaoui, 2009). So far as teaching is concerned, student-centered/active and participatory approaches are taking prominence in regard to reflection on quality teaching in SSA higher education (British Council, 2014). Despite political will to initiate student-centered pedagogies, practice is still dominated by teacher and content-focused (British Council, 2014&

Teferra et al., 2003). With regards to teaching in the context of Rwandan higher education, there is a political will to introduce student-centered teaching methods through the adoption of the Bologna modular system (Mbabazi, 2013; Mugisha, 2010; HEC, 2007 a & b). However, (as indicated in chapter 1.1), transmission-led pedagogies are still dominating (HEC, 2015; Niyikiza, 2014; Mbabazi, 2013; Rwanamiza, 2011; Mugisha, 2010 & Sibomana, 2010; Niyonkuru, 2005). Group work/discussion is the dominating active method used in Rwandan higher education (Niyikiza, 2014; Kagwesage, 2013; Mutwarasibo, 2013). Though appreciated by some students (Kagwesage, 2013; Mutwarasibo, 2013), the practice of group work / discussion is still dominated by teacher supreme authority whereby it is mainly used for evaluation not as learning tool (Niyikiza, 2014: 163). Additionally, where collaborative methods (group works) are used, research-based evidence about tasks provided to groups is missing in the research discourse on Rwandan higher education.

With regard to challenges hampering the implementation of learner-centered education, lack or low level of lecturers' didactical and pedagogic skills (Niyikiza, 2017; Rwanamiza, 2011); limited experiences in deep learning and lack of reading culture as well as unquestionable position of the university lecturers by students (Mbabazi, 2013 & Mugisha, 2010) inhibit the successful use of active methods in Rwandan higher education. Cognitive activation is recognized to be at the heart of active and participatory teaching and learning methods (Krogull et al., 2014). Additionally, cognitively activating complex tasks are important for improving students' competences (Ibid: 2014; Kunter et al., 2013). Unfortunately, pedagogies used in Rwandan higher education tend to focus on rote

memorization as evidenced by tasks given for students during teaching and learning process and assessment (HEC, 2015, Rwanamiza, 2011). From the above literature, it can be deduced that student-centered pedagogies are still new in the context of SSA and particularly Rwandan higher education. The main concern being debated regards the shift from teacher and content dominated teaching by really putting the student at the centre of teaching and learning process. Some strategies were discussed and group work / discussion dominates others strategies being used with some challenges (Niyikiza, 2017 & Kagwesage, 2013).

2.7 Implications

From the literature discussed in the chapter of state of research, two major conclusions can be drawn. Firstly, most empirical studies carried out on cognitive activation by complex tasks were conducted outside of Africa especially in the global north. Secondly, most of them were done on primary and secondary education. Very few were done on the same topic in higher education. Cognitive activation by complex tasks is closely linked to development of students' competencies (Ehlers, 2013 & Le Donné et al., 2016). Unfortunately, research and practice on the concept is silent in the context SSA higher education. The study is then conducted to bridges this gap in terms of both practice and research. With this regard, I describe the methodology used to introduce cognitive activation by complex tasks in Rwandan higher education as well as empirical research on how it is being implemented.

3

METHODOLOGY

In this chapter, I describe the methods used in the present study. The research question of the study is associated with the understanding of processes of educational quality improvement in regard to cognitive activation by complex tasks in Rwandan higher education. With this focus, the study is conceptualized as a controlled intervention followed in this research. The methodology of the intervention is described (3.1) and the research design is presented (3.2).

3.1 A training seminar on cognitive activation by complex tasks

The present part introduces the rationale of the intervention, as method, its relation to educational quality, its objectives, necessity and major steps regarding the intervention.

3.1.1 Rationale of the intervention

Research shows that teaching is at the heart of educational quality improvement (UNESCO, 2014 & 2004). Additionally, the teacher is of utmost importance to improve the students' achievements (Hattie, 2012; 2009; Gathier & Démbelé, 2004). In this framework, pre- and in-service teacher training is one of the hot debate issues in educational research and practice in the search of how to improve teachers' pedagogical and

didactical competencies necessary for quality education improvement (Vavrus et al., 2011; UNESCO, 2014; 2004). Unfortunately, pedagogical professional development of teaching staff in Rwandan higher education is not clearly reflected in theory and practice. Although a modular system was introduced as a means to enhance student-centered pedagogy (HEC, 2007b: 4-5) in order to improve students' competencies in Rwandan higher education, transmission-based methods persist (HEC, 2015; Niyikiza, 2014; Mbabazi, 2013; Sibomana, 2010). As a result, research shows that graduates lack competencies necessary for successful employability including but not limited to responsibility, decision making, practical skills, problem solving skills, risk taking, creativity and critical thinking (HEC, 2015; Mbabazi, 2013).

As a contribtion to addressing the issue, a two[2] days in-service teacher training was organized. During the seminar, teaching staff from one non-governmental higher learning institution in Rwanda was trained on high cognitive activation by complex tasks. The training was planned to enhance the use of active and participatory methods with a special focus on high cognitive activation by complex tasks. As indicated in chapter two (2.3.2), students' competencies are developed only if they are given cognitively complex tasks (Krogull et al., 2014; Ehlers, 2013; Kunter et al., 2013). The training was therefore a contribution to helping teachers understand, design and use challenging tasks that are likely to improve competencies of students.

[2] The training was jointly organized on two criteria of quality teaching: cognitive activation by complex tasks [Emmanuel Niyibizi] and good learning climate [Edouard Ntakirutimana].

3.1.2 Intervention and educational quality

As mentioned in chapter two (2.1.1), quality education is a multidimensional concept with interrelated factors such as context, input, process and outcome (UNESCO, 2004 & Schereens, 2004). With regard to input especially human resources, teacher professional development is recognized to significantly influence educational quality in terms of students' achievement (Lange, 2016; Hattie, 2009; UNESCO, 2014; 2004). In the context of Rwandan higher education, there is no pre-service teacher training. Additionally, policies about in-service teacher training for teaching staff are not systematic. Research shows that rote learning leading to a lack of competences for successful employability still dominates the teaching practices in Rwandan higher education (HEC, 2015; Sibomana, 2010). Therefore, the training on high cognitive activation by complex tasks can be considered a contribution to educational quality improvement. This is the case for three different reasons.

Firstly, research shows that in-service teacher training is a driving force for quality improvement (Lange, 2016; Krogul, et al., 2014; Adebe & Woldehanna, 2013; Vavrus et al., 2011; UNESCO, 2004). As the training conducted for this thesis was carried out as an in-service training to higher education teachers, it can be seen as an input for improving educational quality in Rwandan higher education.

Secondly, the training was organized in order to help teachers improve their teaching practices in regard to active and participative methods and using challenging tasks for later students' competencies improvement. Additionally, active and participatory methods in general and particularly high cognitive activation by complex tasks are important

to improve students' competencies (Krogull et al., 2014; Ehlers, 2013). The training was therefore a contribution to teachers' professional development as regard to content and methodology. With regard to the content, the aim of the training was to provide participants with knowledge on educational quality, teaching quality, competency-based teaching and cognitive activation by complex tasks. On the methodological side, the training was didactically organized to serve as model for participants in regard to active and participatory methods.

Thirdly, as said before, quality higher education in Sub-Saharan Africa including Rwanda is critical with regards to the graduates' competences (HEC, 2015; British Council, 2014; Mbabazi, 2013). The training on high cognitive activation by complex tasks was a contribution to equip teaching staff with pedagogical and didactical competences likely to improve graduates' competencies necessary for competitive national and international labour market. In regard to content, the dimensions of educational quality, the criteria of teaching quality as well as the principle of competence-based teaching were explained and reflected upon. Though the training focused on one criterion of quality teaching, it was an opportunity to frame it in the overall educational quality discourse.

The intervention on cognitive activation by complex tasks was organized as a contribution to quality teaching improvement in Rwandan higher education. First, the intervention was planned as an input to equip teaching with pedagogical and didactical skills in the context of absence of pre- and unclear systematic in-service teacher training in Rwandan higher education. Second, the topic of cognitive activation by complex tasks was selected among

others in order to contribute to the overall challenge of quality higher education in Rwanda in regard to identified competence gaps among graduates. The intervention was organized on the basis of educational discourse showing that cognitive activation by complex tasks is closely linked to students'competence enhancement (Ehlers, 2013 & Fullan & Longworthy, 2014). The objectives, the expected outcomes as well as the necessity of the intervention are described hereunder.

3.1.3 Objectives and expected outcomes of the intervention

Having identified the problem in regard to knowledge and practice about educational quality in general and particularly teaching at higher education level, the general objective of the in-service teacher training for academic staff of the Rwandan HLI was to equip them with knowledge and skills to improve teaching quality in higher education through high cognitive activation by complex tasks. As indicated earlier (chap. 1.1), cognitive activation by complex tasks is embedded in the overall discourse of educational quality and particularly teaching quality. First, participants would understand the overview of the dimensions of educational quality and criteria of quality teaching as well as their relationship. Second, participants were expected to understand and reflect on competency-based teaching in higher education. With the objective, participants would understand the meaning and levels of competencies as well as reflecting on methods used in competency-based teaching and assessment. Third, participants would understand the meaning of high cognitive activation, complex tasks and reflect their importance in improving teaching quality in higher education. Four, teachers were

expected to develop competencies in developing complex tasks in their respective areas of specialization and reflect on how to use complex tasks in their teaching. The objectives of the training were formulated in such a way that teachers gain new knowledge regarding the overview of dimensions of educational quality, teaching quality criteria and cognitive activation by complex tasks. In terms of competences, the training was organized for teachers to develop competences about analysing and developing complex tasks to be used for their teaching. In terms of outcomes of the training, it was expected that trained teaching staff will use active and participatory methods including complex tasks in their future practice. In the long run, it is expected that students' competences will thereby be improved.

The organization of the training was necessary for two main reasons regarding content and process. As content, it was important to help participants understand the concepts of quality education, teaching quality as well as competence-based teaching and particularly cognitive activation by complex tasks. Whatever importance of teaching in the overall educational quality improvement, it was a necessity to give participants opportunities to know and reflect on other dimensions. With regard to process, research shows that teachers teach as they were taught not as they were taught to teach (Vavrus et al., 2011: 71). The training was organized to serve as role model for participants in terms of methods used during the training. A variety of active and participatory including but not limited to silent discussion, query cards, flashlight, group work and presentation, brainstorming, individual reflection, individual work: elaboration of complex task, group work, working with texts, debates, comparison, plenary discussion, debate

methods were used. It was planned to engage participants in challenging tasks allowing reflection but also facilitating learning communities among participants. This was enhanced because professional learning communities are important for improving educational quality through collaborative reflection among teachers (Ibid. & Stoll et al., 2006).

3.1.4 Intervention as method

In the context this study, Intervention is important in the context of knowing how change takes place. In this framework, the intervention was developed in light of criteria of teaching quality discourse to serve as model of participants. The process of the intervention was documented as contribution to conceptual discourse (cf. Chapter 4). The intervention was an opportunity to observe processes i.e. methods of the training offering lessons for initiating changes in the context of higher education. Additionally, the observations of the processes of the intervention opened new insights in research and practice as regard to quality higher education improvement. For example, research shows that professional learning community is important for educational quality (Lee et al., 2013 & Stoll et al., 2006). Observations on how participants collaborate during the training is important for improving the practice of professional learning communities in the context of higher education.

The implementation of the teacher on high cognitive activation by complex tasks training was not conducted as content to be transmitted to participants. Rather, participants were cognitively activated during the training. Knowledge of complex task was not deemed enough without giving participants opportunity to analyse and elaborate complex

tasks taken from their areas of specialization and related to subjects they teach. Therefore, the intervention was not only about cognitive activation by complex tasks but also a process through participants were cognitively activated through complex tasks in their process of learning.With regard to this thesis as part of my Master's degree, the intervention was conducted as preparation of a research programme. Since the concept of cognitive activation by complex tasks is new in the context of Rwandan higher education, it deemed necessary to conduct an intervention and examine its effects through research afterwards. The organization of the intervention requires collaboration, communication and taking decisions regarding planning and implementation. The following describes important decisions made in regard to the training on cognitive activation by complex tasks for teaching staff in one Rwandan non-governmental university.

3.1.5 Principal decisions

In collaboration with senior staff of one non-governmental university in Rwanda, I decided to gather teachers in order to reflect on the teaching practices in the light of educational quality discourse. The training on high cognitive activation by tasks was not only an opportunity for learning new content for improving teaching. Rather, it was important occasion for teaching staff to identify weaknesses in their teaching, realize underlying factors and think about how to overcome them. This was done by allowing participants reflect their current teaching practices in the light of evidence-based knowledge regarding teaching and learning in the context of higher education. With this regard, 19 members of teaching staff were trained including permanent and part time lecturers. The training

was organized 21-22nd February 2017. The time was short due to financial limits coupled with limited availability of academic staff. There were not enough funds to support the training for an extended time. Additionally, it was quite difficulty to have teaching staff for more than two days. This was the case since the training took place during the period of the end of term examinations.

Having identified the problem regarding teacher professional development; persisting banking education (Sibomana, 2010; Freire, 2005) leading to low level of competencies among graduates in Rwandan higher education (HEC, 2015; Mbabazi, 2013), the training was organized as one alternative solution. The planning and implementation of the intervention is an opportunity of learning in regard to staff professional development in the context of higher education. Apart from the focus of the training, it was an opportunity to identify challenges related to in-service teacher training in higher education. Additionally, the training offered insights about capacity building gaps among teaching staff in higher education. The intervention was therefore a chance to not only learn from the processes but also to reflect on future propositions for the improvement of in-service teacher training in higher education. As mentioned earlier, the training was organized as a controlled intervention followed by empirical research. The following part describes research methods.

3.2 Research methods

In this sub-chapter, I describe the overall research approach used in this study as well as the methods of data collection, analysis and interpretation. I decided to conduct qualitative research project by using semi-structured interviews. I likewise explain the method of data analysis:

content analysis. Additionally, I also explain the sampling technique applied in the study and the constitution of the final sample. Furthermore,challenges encountered while carrying out the study and the limitations are described. The sub-chapter ends with a conclusion.

3.2.1 Qualitative research approach

In scientific research, there are three research approaches namely: qualitative, quantitative and mixed (Cresswell, 2014; Kumar, 2014; Amin, 2005). The choice of one or another approach depends on the research purpose to be undertaken (Creswell, 2014 & Dey, 1993). Referring to research question of the present study, qualitative approach was adopted. Qualitative research is an approach used for the purpose of describing how people interpret and understand their experiences and the world in which they live (Kumar, 2014; Savin-Baden & Major, 2013). In the description of people's interpretation and understanding of lived experiences, research has to be carried out in the natural context of the participant and take the same context into account when collecting analysing and interpreting data. In qualitative research, the emphasis is put on description of people' meanings about their realities and this through communication (Creswell, 2014; MacMillan & Schumacher, 2014; Savin-Baden & Major, 2013).

Within qualitative approach, there are different sub-approaches among which the researcher chooses depending on the purpose of the study (Savin-Baden & Major 2013: 213). The present study falls under phenomenological approach. Phenomenological approach is one of qualitative approaches, which aims at describing participants' experiences about a given phenomenon (Gentles, Charles, Ploeg & McKibbon; 2015 O'Leary,

2010). As the study was carried in order to understand how teachers in one Rwandan HLI interpret their experiences and challenges about the implementation of cognitive activation by complex tasks, qualitative approach fits with the purpose of the study. In phenomenological qualitative study, it is recommended to rely on personal interpretations of their experiences through participant interviews (Gentles et al., 2015 & Creswell, 2014). In this framework, semi-structured interview method was used in the data collection.

3.2.2 Method of data collection: Semi-structured interview

Semi-structured interview is one of the methods of data collection used in qualitative research (Savin-Baden & Major, 2013; Cresswell, 2014; Kumar, 2014). Through semi-structured interview, a researcher collects data during a conversation between two individuals: the researcher (interviewer) and participant (interviewee). In the semi-structured interview, the interviewer asks pre-set questions with flexibility to ask additional questions (Savin-Baden, 2013; Robson, 2009). Questions should be related to topics corresponding to the research questions the researcher seeks to answer (Kumar, 2014; Amin, 2005). The additional questions are asked in order to probe information on unsatisfactorily or unclearly answered questions during the interview. Semi-structured interviews can be face-to-face or through other channels of communication including email or telephone (Creswell, 2014; Savin-Baden & Major, 2013) and social media. Face-to-face semi-structured interviews were used in the study at hand.

In this study, semi-structured interviews were selected for two main reasons. The first is linked to comparability of responses among participants (Savin-Baden & Major, 2013; Cohen, Manion & Morrison, 2007). Participants are asked questions related to pre-set topics corresponding to research questions of the study. This eased comparison of responses from participants about the issue under investigation. The second is linked to the opportunity to conduct interviews. Due to the flexibility to ask questions for clarification or extension, semi-structured interviews allowed flexibility in terms of asking more questions in order to get the maximum of data.

Inspired by Kumar (2014), Savin-Baden & Major (2013), Miller, Birch, Mauthner & Jessop (2012), Dawson (2009), Cohen, Manion & Morrison (2007) and Robson (2007) I carefully planned and conducted the semi-structured interview related to the study. I developed the interview guide. Referring to Savin-Baden & Major (2013: 366), three types of questions namely initial, questions for collecting depth data and final question. The interview guide was developed in English and later translated into Kinyarwanda. Though English is a medium of instruction in Rwandan higher education, one might feel comfortable when expressing her / his ideas in the mother tongue. Two participants are native speaker of Kinyarwanda and one uses only English. During the pre-interview dialogue with participants, two Kinyarwanda native speakers decided to answers the questions of interview in English (See 3.2.4 about the sample.

Before conducting the interviews, the researcher explained the purpose of research and the interview process. Ethical considerations of the interview especially seek the

acceptance of the participant to be recorded or right to withdrawal were explained. As mentioned earlier (Chap 1.1), the study was conducted after intervention. With this regard, interviews were conducted three months after the intervention was implemented. The interviews were conducted on the following respective dates.

The first interview with Imanzi was done on 2nd June 2017. It was conducted at home of the interviewee from 11.30am. The duration of the interview was 1hours 10 minutes 30 seconds. The second interview with Imena was done on 5th June 2017 in my office from 4.30pm. The duration of the interview was 44 minutes 29 seconds. The third interview with Ingenzi was done twice. The first was conducted on 7th June 2017 in the office of the interviewee from 11.42am and took 27minutes and 48 seconds. The second part was done on 23rd June 2017 in a classroom and took 13 minutes 13 seconds. Voice recorder and taking notes were combined to capture the content of the interview. After conducting interviews, the following steps was to analyse and interpret collected data.

3.2.3 Method of analysis and interpretation: Content analysis

In this section, I explain how collected data was prepared, analysed and interpreted. Collected data was transcribed to have a verbatim to be analysed. In qualitative research, data analysis is defined as a "[…] process that involves breaking data into meaningful parts for the purpose of examining them" (Savin-Baden & Major, 2013, p. 434). This consists in organizing data by identifying patterns, themes, and relationships, meanings and critiques among collected data. It is a process of transformation of raw data into manageable information, which facilitates the process

of making sense out of collected data (Creswell, 2014; MacMillan & Schumacher, 2014; Savin-Baden & Major, 2013).

There are different qualitative data analysis methods (Savin-Baden & Major, 2013; Amin, 2005). Qualitative content analysis is a method of analysis, which requires a process of objectively and systematically examining the texts (i.e. verbatim transcribed from interview) (Savin-Baden & Major, 2013; Dawson, 2009). The analysis of the text requires assigning codes, which allow to identify the major characteristics (patterns, themes / categories, relationships) of the texts (Creswell, 2014; Dawson, 2009). The method was chosen based on its fitness to the purpose of the study. As content analysis focuses on analysing "meanings, context, and intentions contained in messages" (Lal Das & Bhaskaran, 2008, p. 173), the study used content analysis to analyse the content of the messages of participants' experiences and challenges in regard to the implementation of cognitive activation by complex tasks in Rwandan higher education.

Inspired by Creswell (2014), MacMillan & Schumacher (2014), and Savin-Baden & Major (2013) the collected data was transcribed after each interview. After transcription, the analysis was done by first reading and rereading the transcripts to get the general meaning of the data. The reading was followed by carefully analysis of each transcript to find the patterns and themes. The description was done using mixed approach. The approach indicates that the analysis of data is done by using pre-identified themes as well as other themes or sub-themes identified during the process of data analysis. In the context of my study, themes were identified in light of research questions

the study sought to answer. The general question of the study was to understand how teaching staff implements cognitive activation by complex tasks in Rwandan higher education. Specific questions were to investigate how teaching staff cognitively activates students, use complex tasks and challenges they encounter when using complex tasks. Additionally, other related themes and sub-themes were progressively identified during process of describing data. The description was done following the themes and sub-themes already identified and generated from the data. After, I interpreted the findings by showing the summary of the results.

3.2.4 The Sample

In qualitative research, the purpose is not to make generalizations rather to understand how people interpret phenomena. The issue of representativeness and then quantitative generalizability are not the main concerns of qualitative research (Kumar, 2014; MacMillan & Schumacher, 2014). The process of selecting the sample in qualitative research is therefore mainly based on non-random sampling. Sampling strategies in qualitative research are mainly purposive (Kumar, 2014; MacMillan & Schumacher, 2014; Cohen, Manion & Morrison, 2007; Creswell, 2014). The selection is based on the purpose fitting with the one who can provide information related to the issues under investigation. Scholars identify several strategies, which are useful in qualitative research. They include snowball, convenience, judgmental, expert and theoretical sampling (Kumar, 2014; Cohen, Manion & Morrison, 2007).

In the context of the present study, purposive sampling was used. Purposive sampling, also called judgmental,

is a strategy where the researcher purposively selects typical participants who are expected to provide the best information regarding the research question (Kumar, 2014; Cohen, Manion & Morrison, 2007). This strategy was selected because of the nature of the study. As indicated in chapter 3.1., intervention (in-service teacher training) was organized for one Rwandan non-governmental university on cognitive activation by complex tasks. As cognitive activation by complex tasks is a new concept in Rwandan higher education, participants were selected among trained teachers especially those who and fully participated to the training. There were three participants in this study. Purposively selected, participants came from three areas of specialization namely theology, education and development. In terms of gender, two females and one male lecturers were interviewed. For the purpose of anonymisation, participants were given three names of national categories of heroes, namely: Imanzi, Imena and Ingenzi. Moreover, the name of the HLI was not mentioned. The following subpart describes the challenges encountered in the empirical research.

3.2.5 Challenges encountered

Because of the conflicts of programs that stressed one intervewee, it became necessary to organize a second session with the participant. During the second session, missing data were collected.

3.2.6 Limitations

The limitations of this study are of methodological nature, especially related to qualitative approach. First, the data do not lead to generalization. Though data were collected from teachers who participated in the training

on high cognitive activation by complex tasks, the findings cannot be inferred to all participants. The findings reflect individual experiences of teachers who participated in the study. Second, the empirical study was not carried out for the purpose of evaluating the intervention. However, the findings may provide information which may sheld light in the evaluation of the intervention.

The study did not compare experiences of teachers before and after the training, there might be other factors, which were not identified. With this regard, the findings cannot fully attributed to the training. Other factors such educational or professional background might have influence on how participants implement high cognitive activation by complex tasks in Rwandan higher education.

Though the study put emphasis on experiences and challenges of teaching staff about the implementation of high cognitive activation by complex tasks, other aspects of quality teaching were not deeply analyzed. This is not because they are less important. This was due to the scope of the study.

3.2.7 Ways forward

The chapter 3 describes the methodology used to find answer to the identified problem (cf.1.1) on the input (lack of pre-service teacher training in Rwandan higher education), process (persistence of teacher-dominated pedagogies) and outcome (critical competences among university graduates). The tentative to address the problem was tackled both at praxis and research levels. On the praxis, the intervention on cognitive activation by complex tasks was organized as a contribution to equip teaching staff with pedagogical and didactical knowledge

and skills to improve the quality of teaching. The focus on cognitive activation by complex tasks was planned and implemented to equip teaching staff with knowledge and skills about how to improve students' competencies. The intervention was likewise organized to bring about change in regard to practice of teaching in one non-governmental university in Rwanda.

As mentioned earlier, the intervention was planned and implemented as controlled intervention followed by research. Empirical research was carried to understand how the innovation introduced is taking place. Though it was not done as an evaluation, the study at hand is important to enlighten practice and theory about teachers' experiences and challenges concerning the implementation of cognitive activation by complex tasks as change introduced in their teaching practices.

The combination of the two methods-intervention and empirical research was important for two reasons. First, the concept of cognitive activation by complex tasks is new in the context of Rwandan higher education. It was then important to introduce it and then learn how it is being implemented through empirical research. Second, the empirical research findings can inspire future intervention on the same topic. As indicated earlier, the intervention on cognitive activation by complex tasks was conducted as one the methological aspects of this thesis. In the following chapter, I give the details about planning and development of the same intervention.

4

TEACHER TRAINING ON COMPLEX TASKS

As it was shown in (chap 2), cognitive activation by complex tasks is important for educational quality. However, the concept is missing in the context of teaching in Rwandan higher education. Moreover, rote pedagogy inhibiting the development of competences among students for successful employability is still a reality in Rwandan HLIs. More on that, policies and practices of pedagocal and didactical professional development of academic staff is unclear. Therefore, I decided to conduct in-service teacher training for academic teaching staff as contribution to the abobe mentioned issues. The training on high cognitive activation by complex tasks was organized for teaching staff of one Rwandan higher learning institution. It took place on 21-22nd February 2017 in the building of the institution. Targeted participants were mainly permanent and part time teaching staff with or without other academic responsibilities. Among others, Deans of faculties, heads of departments and directors were invited. As regard to specialization, expected participants' areas of specialization were mainly arts and social sciences including education. Their qualifications vary from Bachelor to PhD degree. The present chapter describes the objectives, the didactical planning and the development of the intervention.

4.1 The Objectives of the training

As indicated earlier (3.1), the topic of the training for teaching staff of one non-governmental higher education was done on high cognitive activation by complex tasks. Cognitive activation by complex tasks is one driving criteria of quality teaching leading development of competencies among students (chap 2.3.2). Additionally, it was organized as a contribution to educational quality improvement in the context of Rwandan higher education. The latter face a lack of professional development of teaching staff, persistence of transmission-led pedagogies as well as critical competences among university graduates (chap 1.1). The overall objective of the intervention was to improve quality teaching through cognitive activation by complex tasks. As previously indicated (chap 2.1.1), the concept of cognitive activation by complex tasks is embedded in the overall educational quality discourse. Specifically, it is one of the criteria of quality teaching (Le Donné et al., 2016; Kunter et al., 2013) and closely linked to competency improvement (Ehlers, 2013; Krogull et al., 2014). Additionally, the problem of the study under investigation (chap 1.1) has to be reflected with other dimensions of challenges of overall educational quality and teaching in the context of Rwanda (Chaps 1.1 & 2.4). In this framework, participants were to firstly understand the dimensions of educational quality and criteria of teaching quality. Teaching is influenced by different factors within and / or outside classroom and the educational institution (UNESCO, 2014 & 2004). It was deemed appropriate to start by the dimensions of educational quality to give teachers in higher education the opportunity to reflect on other aspects, which influence the teaching and learning process. Overview of the criteria of teaching quality was explained to show that improving

teaching quality requires different and interrelated aspects. Secondarily, the concept of cognitive activation by complex tasks is closely link to competency enhancement (cf.2.3.2). Additionally, Rwandan higher education face a challenge of dominance of banking education related teaching practices leading to lower level of students' competencies (chap 1.1). Participants should develop understanding and reflect on competency-based teaching in higher education.

Thirdly, persistence of rote learning might be due to limited knowledge about active and participatory methods including complex tasks as a result of both previous learning experiences and lack of appropriate in-service teacher training (chap 1.1). Importance of cognitive activation by complex tasks in overall educational quality improvement and particularly quality teaching cannot be underestimated (chap 2.3). With this regard, teaching staff participating in the training were expected to have profound understanding of high cognitive activation, complex tasks and its necessity for improving quality teaching in higher education. This was necessary to allow participants have conceptual understanding of the concepts before reflecting and learning how to implement them in their teaching practices.

Fourthly, research shows that teachers easily transfer teaching practices when the training is closely related to their teaching experiences (Lipowsky & Rzejak, 2015; Vavrus et al., 2011). Additionally, one of explanation of teacher-domination pedagogy persisting is mostly linked to previous rote learning experiences. Therefore, knowledge was not enough for participants to use complex tasks in their teaching. Participants were given opportunity to analyse complex tasks during the training. Additionally,

they exercised them to develop complex tasks for subjects they teach whether individually and in groups. This was done in the context of overall active and participatory methods used during the training to serve as role model for participants.

4.2 The didactical planning

For an effective and efficient implementation of the intervention, different activities took place in regard to planning. In this perspective, I explain didactics of the training, didactical planning as well as critical discussion of problems encountered.

4.2.1 The didactics of the training

The didactical aspects, the content and methodology of the training were in line with the objectives of promoting high quality teaching (Kanter et al., 2013; Hattie, 2009; Dean et al, 2012) as well as competency-based teaching (Hoogveld, 2003). The framework was important in order to help participants become aware of other aspects to take into consideration when improving educational quality in general and particularly in the teaching and learning process in higher education. Additionally, the main topic of the training is closely linked to competency improvement (Krogull et al., 2014; Hattie, 2012; Kanter et al., 2013). In this framework, it was necessary to give participants the opportunity to reflect on competency-based teaching. We explained the reflected with the participants on the meaning, types, levels of competencies and how to adopt competency-based teaching. The training started by reflecting and explaining the meaning of cognitive activation and methods to cognitively activate students in teaching. Complex tasks were explained as one of

strategies of cognitive activation. As the training intended to allow participants develop an understanding, analyze and develop complex tasks, characteristics of complex task were explained to serve as framework during the analysis and elaboration. Apart from analysis and elaboration of complex tasks, it deemed necessary to reflect on how and when to use complex tasks in teaching and learning process. The content was not enough to determine the success of the intervention. In addition to the content, the methods to be used were deeply reflected. Teachers easily transfer teaching methods, through which they were trained to their classroom (Lipowsky 7 Rzejak, 2015; Vavrus et al., 2011). Additionally, research shows that transmission-based pedagogy is still dominating in Rwandan higher education (HEC, 2015; Niyikiza, 2014; Mbabazi, 2013; Sibomana, 2010). This led to adopting active and participatory methods expecting that participants would transfer them to their teaching practices. Individual reflection, individual, pair and group work, discussions (in groups and plenary), analysis of complex tasks given as examples, developing complex tasks in different areas of specialization are examples of activities used to engage participants in the process of training. Participants were not told the characteristics of complex tasks. Rather, they were involved in analysis and elaboration of complex tasks of their own choice and from their areas of specialization. In the same orientation, participants were not told the meaning of cognitive activation. The training itself was organized to cognitively activate participants. For example, dimensions of educational quality were not presented as if participants were ignorant about quality education. Rather the session was planned in such a way that participants give their ideas about the topic in a brainstorming activity

before the input presentation of the trainer. Using active and participatory methods in such training was supported by research findings, which call for active participation in the context of adult education (Finn, 2011; Rogers & Horrocks, 2010). Active and participatory methods are not only important for helping participants understand the content by also allow reflection and contextualization. The latter are important for a change of perspectives when participants are given opportunities to confront their previous practices with new knowledge. Additionally, since participants had experiences in teaching, active and participatory methods were used to allow reflection on the practice.

4.2.2 Implementation of the didactical planning

Administratively, the organizer took advantage of the role of communication in project management and talked to different people. The top managers of the institution were contacted individually as well as other influential expected participants. The purpose of the individual contact was to enable discussion about the relevance of the training, objectives and expected participants. As leadership plays an important role in bringing about change in educational institutions (Hattie, 2012: 153-154), influential leaders were both visited. It was necessary to have the approval of the top management to invite participants. To ensure the success of the training in terms of attendance, invitations were given two weeks before the training took place and one week later the timetable was sent to the participants. Recognizing the role of communication in project management (Imas & Rist, 2009; Westland, 2006), different means of communication were used such as printed media, electronic-emails and phone calls to

keep in touch with the staff invited.Logistics planning is important in the success of an intervention in research (Westland, 2006: 56-89). However, it is not always that good planning implies good implementation due to unpredictable challenges beyond the organizer's control. Before describing how the intervention was implemented, it is necessary to make a short discussion on problems encountered.

4.2.3 Problems and discussion

The problems encountered are basically related to time management, management of multi-expertise of participants, resistance to change and infrastructure and equipment. Time management is important for both quality teaching and quality in service teacher training (Ugwulashi, 2013; Hattie, 2012; UNESCO, 2004). During the training, lateness was observed in both days for most of participants. It was necessary to reallocate and reduce time, which was reserved for other activities during the training. This is a very important aspect, which needs to be reflected on improved in the context of teacher training.

As indicated earlier, the training was attended by a diversity of participants in terms of qualification, age, gender, experience, specialties, administrative and academic positions. Though for the seminar was organized as a forum for mutual learning, it was observed that senior staff and experienced teachers tended to over-dominate the interaction with other trainees. To solve the problem, communication skills in respect of participants was helpful to manage multi-expert group of participants. Additionally, doing challenging tasks in groups was important to allow discussion among participants. Coupled with the same problem, resistance to change was observed especially

during individual reflection and work. The training on high cognitive activation by complex tasks was implemented as a process of bringing about change among teaching staff. Though resistance is sometimes unavoidable, allowing the prticipants to express their thoughts and beliefs about the topic and process of the training minimized the effect. Infrastructure and facilities are important to improve educational quality (Sheernes, 2004; UNESCO, 2004). In the context of the training, frequent electricity breakoffs would have heavily disturbed the training; the problem was resolved well before the training. Presentations and working sheets were all printed to be used in the case of interruption of electricity. This was important to have different alternatives in planning.

4.3 The development of the training

As explained earlier (4.2), all necessary preparations were made before the training. This section explains how the intervention was implemented under headlines of the course of the training, training in regard to its objectives and changes in regard to the didactical planning.

4.3.1 The course of the training

The training was officially opened and closed by top academic managers of the institution. This was a sign of the support of the intervention. The opening speech was an opportunity to express the institution's aspirations concerning professional development of teachers in higher education. The gaps in pedagogical and didactical skills among academic teaching staff (HEC, 2015; Mbabazi, 2013; Sibomana, 2010), coupled with a lack of inservice training, the objective to improve students' competencies were raised to emphasize the relevance of the training.

4.3.2 The training in regard to its objectives

As indicated in 3.1, the first three objectives related to dimensions of educational quality, criteria of teaching quality and competency-based teaching were presented and reflected on in order to frame the core purpose of the training related to high cognitive activation by complex tasks. For each of the topics, the input presentation was always accompanied (before or after) by reflection of participants (individually or in-group). This was done for the purpose of getting participants engaged in the training by using and confronting their previous knowledge and practices with the content and practice of the training.

As the training was organized to serve as role model for participants, active and participatory methods were used. These included but are not limited to brainstorming, flashlight, pair and group work, individual reflection, analysis of complex tasks, elaboration of complex tasks (See didactical plan, annex 2). Like any teaching and learning process, the training took into consideration other aspects to ensure the efficiency of the teacher training including constructive feedback, enforcing professional learning communities, good learning climate, and good teaching practices (Lipowtsky & Rzejak, 2015: 29-40). As research shows that constructive feedback is important for improving learning (Hattie, 2012: 115-136), constructive feedback was regularly given to participants after different tasks by both trainers and trainees. Moreover, the role of professional learning communities cannot be underestimated in the process of teaching and training (Jones, Stall & Yarbrough, 2013: 360). With this in mind, the training allowed different opportunities of collaboration among participants through pairs or group work. For

example, participants were asked to elaborate complex tasks in groups related to different areas of specialization. Being aware of the fact that a good learning climate is a predictor for the success of the training (Lipowtsky & Rzejak, 2015: 42) aspects such as mutual respect between trainees and trainers or responsibility through different tasks were emphasized during the training. The relaxed environment with challenging tasks including analysis and elaboration of complex tasks was enhanced during the training to reflect on how students should be engaged in a conducive teaching and learning environment.

4.3.3 The changes in regard to the didactical planning

The future is not always predictable. But apart from some changes related to the dates of the training, the number of participants and the order of activities, the didactical plan was implemented as planned. Due to important other activities that were planned on the same dates of the training and upon agreement with the administration of the university where the training took place, the dates of the training were changed from 8-9th to 21-22nd February 2017. Additionally, 20 participants were invited. This was due to financial limitations. I had planned that participants would be given examples of complex tasks just after explanation of characteristics of a complex task. However, it was reflected during the training that to cognitively activate participants, I decided to ask them to elaborate complex tasks in light of the given characteristics before giving some complex tasks as examples for analysis. This was done for the purpose of helping participants understand the meaning of the characteristics of complex task by learning from the process itself.

4.4 Lessons learnt

The implementation of the training on high cognitive activation by complex tasks was a learning opportunity in regard educational quality improvement. Among others, I reflect on collaboration, initiation of change, in-service teacher training and research. As educational quality is multi-dimensional and multi-stakeholders (Sheerens, 2004; Gauthier & Démbelé, 2004; UNESCO, 2004), collaboration is an important aspect to be reflected when improving educational quality. About the intervention, it was an opportunity to use different skills and expertise for the success of the training. Collaboration between administrative and academic leadership was important to have an opportunity to organize and implement the training.

The training was organized as a means to initiate change in teaching practices in Rwandan higher education. With this regard, strategies, challenges, resistence to change were reflected. Additionally, flexibility in terms of managing unpredictability was important in regard to initiation of change in the context of higher education. In the context of the in-service teacher training, it was observed that with small but focused and progressive initiatives, teaching quality can be improved. Furthermore, processes and challenges of conducting in-service teacher training in light of criteria of teacher training were reflected for future teacher professional development in the context of Rwandan higher education. The training opened new areas of focus for teacher training. The need for training on other criteria of quality teaching was highly requested.

As one of university mission is research, the intervention was an opportunity for teaching staff to explore new areas

of research. For example the importance of individual support in improving educational quality attracted the attention of participants. Deepening the criterion and conducting scientific studies on how to ensure individual support in the context of big classes were recommended.

4.5 A look back to the intervention

The evaluation of participants after the training shows that they appreciated the content and relevance of the training as well as the methods used. Besides, participants found the training useful for improving their teaching. During the follow up, it was found that complex tasks became a framework, through which tasks to be given to students are elaborated and assessed. However, it is not always easy for teachers to elaborate demanding tasks for students (Senn & Marzano, 2015; Hoogveld, 2003). Elaboration of complex tasks was still challenging teachers. Follow up trainings and professional learning communities are to be enhanced. As a higher learning institution whose triple mission is teaching, research and community services, the training opened new opportunities in all three areas. Participants expressed high interest in the criteria of quality teaching and requested to enlarge the training on other criteria. Moreover, the question of individual support particularly interested participants so that they proposed to conduct research on how to offer individual support in the context of big classes. Additionally, participants proposed to deepen the training so as to be able to support the implementation of the new competency-based curriculum in nursery, primary and secondary schools that the government of Rwanda had initiated in 2015.

In a nutshell, quality education has become a hot debate in educational research and practice worldwide. However,

knowledge and skills to develop educational quality is still limited. Whatever small, the training was an opportunity to help participants get to know and understand the dimensions of educational quality and their interactions, criteria for teaching quality improvement and how to improve students' competences through cognitive activation by complex tasks. Additionally, the use of active and participatory methods was important for participants to reflect, contextualize, confront and challenge their own previous teaching practices. The concept of complex task was introduced and has become the framework, through which tasks and exercises given to students are developed and assessed. Observations show that in-service teacher training coupled with enhancement of professional learning communities among teaching staff would be a contribution to improving teachers' pedagogical and didactical knowledge and skills and in the long run improve students' competencies.

As it was indicated in chapter 3, the controlled intervention was followed by empirical research. In the following chapter, I describe the data collected and summarize the results of the study.

5

FINDINGS OF THE STUDY

As indicated in chapter 1.3, the present study intended to investigate teachers' experiences and challenges in regard to the implementation of cognitive activation by complex tasks in Rwandan higher education. Specifically, the study was carried out to answer the following research questions: How does academic staff cognitively activate students in their teaching? How does teaching staff use complex tasks to cognitively activate students? What challenges do teaching staff face when using complex tasks in their teaching? Three semi-structured interviews were conducted with selected teachers who participated in the training (chapter 3.2.4) and the collected data was analysed with content analysis (3.2.3). For anonymization, interviewees were given names: Imanzi, Imena and Ingenzi. In the the following sections, I first describe the data collected,then then present the results.

5.1 Description of data

In chapter 3.2.3, the analysis of data was done by identifying themes related to research questions and other themes emerging from the data in relation to the issue under investigation. In this process, five themes were identified. As the topic at hand is embedded in teaching, I firstly describe teachers' conceptions of teaching.

Secondly, I present data related to cognitive activation methods reported to be used by interviewees. Thirdly, data about how interviewees use complex tasks in their teaching are presented. Fourthly I respectively describe the challenges and strategies used to overcome them when using complex tasks.

5.1.1 Teachers' conceptions of teaching

Data from interviewees show that participants have different conceptions about teaching. It is revealed by the data that participants conceive teaching as facilitation, learning, participation, interaction and contextualization. With regard to facilitation, two participants indicated that teaching is a process of facilitating students' learning. One of the participants said: "I don't teach. I don't know even how to teach. I facilitate my students to learn. And I believe from that I also learn. So, I don't prefer the word "teaching", but rather, facilitating my students to learn (Ingenzi). Ingenzi indicated that with facilitation, students are given opportunities to participate by researching knowledge and space to freely express what they know or found. Additionally, she shows that teaching is also an opportunity to learn on the side of teacher. In her perspective, the teacher is not the source of knowledge. Rather, there is reciprocal learning- between teacher and students. In regard to teaching as participation and interaction, Imanzi made it clear that teaching, especially languages like English has to be interactive and participative. In the same orientation, Imena indicates that students have to be engaged in many activities. For Imena, the Teacher's role is to introduce students to topics and then give them opportunities to deepen the content through interaction and collaboration. Class discussion, pair and group work

are reported to be used as tool for engaging students and enhance their interaction in the process of teaching and learning. Additionally, all participants indicated different tasks prepared and given to students during teaching and learning process. They include readings, summarizing, exercises and presentations.

So far as teaching as contextualization is concerned, Imanzi stated: […] "as much as it is possible to contextualize that information-because if it does not relate to who they are and where they are, they are not going to learn". In the perspective of the interviewee, teaching has to relate content to students' level and living context. Moreover, the same interviewee explains teaching as contextualization in regard to how the content can be used. "In terms of contextualization, what I try to do is: everything I teach, put it in the context of how they will use this. What does it mean if they learn how to do this? How will this enable them to grow, to be better at what their field of study is if they can learn this? I try to help them see how that material relates to what they are going to be doing. Why is it important to learn English if you are going to be teaching in Rwanda? That kind of contextualization" (Imanzi). In the conception of the interviewee, teaching as contextualization concerns related content to nature of students and their living context as well as its importance outside the classroom context.
Participants conceive teaching as facilitation, learning, participation, interaction and contextualization where students are to be actively engaged in different tasks. In the following sub-chapter, I present data regarding teaching methods reported to be used by interviewees. In line with the topic of the study, data about cognitive activation methods used by participants is described.

5.1.2 Cognitive activation methods

During interview, participants reported that they use different teaching methods. In English language, Imanzi indicated that teaching methods dependent on level of students and content. Teachers reported that they used application exercises in lower levels where students have to increase vocabularies and enhance grammar. Additionally, short writing are used to help students develop writing skills. Imanzi expresses it in the following sentences: “If I’m doing basic English, one of the biggest applications for them will be: can they write a paragraph? It puts together everything. It’s the grammar, the vocabulary, the coming together of ideas”. In the advanced English where students are to be engaged in academic language “critical reading and critical writing”, critical reading and text analysis are used. This can be justified the following excerpt: …So I’ll give them a variety of different readings from different perspectives and different points of view. I’ll have them look at those and see – do they understand that reading. Do they understand the author’s point of view? Why is the author taking that perspective? We discuss that, and how they came to that conclusion” (Imanzi).

In theology, learning preaching through preaching exercises, biblical text analysis (exegesis), group work and discussions are mostly used. With regard to preaching, participant indicated that she used to ask students to choose one biblical text, prepare a sermon and preach it in front of classmates and teacher considered as congregation. After preaching, they get feedback from both teacher and classmates. Imanzi said that each student has to prepare and deliver at least two sermons, through which they integrate and apply different theories about preaching.

Additionally, data shows that group or class discussion is used in theological courses. Two participants gave examples. The first is about the biblical analysis of the book of Romans where students were asked to discuss about the meaning of the selected text and contextualize it in their cultural context. The second is the following: "If you are going to be talking about something like the origin of sin…: all have sinned and fallen short of the glory of God, what does that mean? How do you understand that? Why did Paul say that?" (Imanzi). The interviewee reported that such question can be better answered when it is discussed in groups.

In the same orientation, Ingenzi reported to use different methods including analysis of picture and video, role plays, project, drawing, portfolio, case studies and readings in her teaching. For example, "[…] sometimes I just bring like a picture. For example if we are learning on prejudicism […], I can bring a picture, picture that different people would interpret it in different ways and from those differences of interpreting a picture, it is already a learning that we learn and then I just have to come up with a conclusion that we are, all unique, we are different, but we are all beautiful for example" (Ingenzi). In the understanding of the interviewee, students interpret the picture from each one's perspective and then draw lessons from the diversity of interpretations. Another example given by the same interviewee is about drawing as means to advocate for problems in the society. Data collected shows that Imena reported to use reading and then summarizing, group or class discussion and scenario in his teaching. Imena indicated through scenario, students apply theories learnt in analysing real life situations and develop problem solving skills. For scenario, Imena indicated: "[…] but most

importantly is to give a scenario like giving an instance of a strake of workers somewhere and I ask students to criticize using the theory of hierarchy of needs, such kind of question". The interviewee said that such question is "complex and demanding", which requires understanding of the theory and also its application in order to analyse the situation. According to the interviewee, such question require more than memorization of the theory. Data from three interviewees show that working with texts (reading, summarizing, exegesis, critical text analysis, writing essays and short papers), discussion and case studies are commonly used. Additionally, it is shown that one participant (Ingenzi) reported to use a variety of methods as compared to others i.e. analysis of picture and video, role plays, project, drawings and portfolio. Moreover, one reported method is particular for subject –learning preaching through preaching practices. In addition to description of cognitive activating methods reported by participants, I focus on the description of data in relation to how participants use complex tasks in their teaching.

5.1.3 Using complex tasks

Data related to the use of complex tasks in teaching was presented by first describing interviewees' understanding and importance of complex task. I secondarily present the data collected as regard to what interviewees reported to consider when developing and how they use complex tasks in their teaching.

Understanding and importance of complex tasks

Evoked by two interviewees during interviews, understanding of complex tasks was described by considering participants' conceptions as well as examples

of given during interview. When asked what they understand by complex task, all interviewees answered with doubts to the question in three perspectives: characteristics of complex task, purpose and cognitive requirement. For two participants (Imanzi & Imena), complex tasks are tasks, through which students foster understanding, integration, transfer and application of knowledge and skills. With regard to characteristics, all interviewees show that complex tasks are related to real life of students-contextualization. For one participant, complex task is understood as task that requires students to think, analyse, connect with their life experience and content as well as make critical reflection (Ingenzi).

In the same line, two examples of complex tasks given by participants fulfil the characteristics of complex tasks namely real-life relevance, levels of competences and responsibility. The first example given by one interviewee is: "I gave an exam for Roman exegesis and I said: Discuss Paul's perspective, definition and use of justification by faith. And explain how you would use this in your preaching. So they have to look at what Paul has said about justification and explain how they would apply it in their own work. Do they understand? Can they communicate it? Can they apply it?" (Imanzi). The example shows that the task given is complex. First, the task is related to real life of students in Theology-reading and analysis of biblical text as well as preaching. Second, the task shows different types and levels of competences. In the tasks, students use and develop competences including reading, writing and communication, which recall others such as analysis and critical thinking in order to show how and where the text should be preached. The example of task requires different levels of reading competences-basic reading,

understanding critical reading in regard to the reflection on the text for its later contextualization. Third, students take their responsibility in regard to how they have to do and organize the work.

Another example is a portfolio given to students by Ingenzi. In the course of post-war reconstruction, Interviewee reported to have asked students to follow international news related to conflict and war interventions. Students had to write the summary of news and their reflection in relation to the course. Following news is human to know what is happening around him / her. So, the task is real life relevant. Students require to integrate different sources of knowledge as well as use and develop different competencies. Different levels of language, linguistic competences-listening and writing, understanding of the content, critical thinking-reflection on the news in related to content are necessary to do such complex task. Additionally, students develop metacognitive skills as regard to finding strategies to successfully do the task.

With regard to the importance of complex tasks, data revealed that participants show the importance of complex tasks in different perspectives. First, it was reported that complex tasks offer opportunity to learn for students. One interviewee shows that complex tasks are the only way to help students learn. For her, it is the only way, through which students are given opportunity to explore other sources of knowledge than teacher but also fulfil learning outcomes (Ingenzi). Second, data shows that complex tasks are seen as tool for enhancing students' participation in the process of teaching and learning. Imanzi indicated that complex tasks are used to facilitate participation of all students whether individually or in group. Additionally,

Ingenzi indicated that students work hard and concentrate when performing complex tasks. Third, using complex tasks is seen as tool to enhance students' collaboration. One participant said that with complex tasks: "[…] you can see that everyone wants to contribute and put much effort […]" (Ingenzi). Four, complex tasks are considered as important in terms of bringing interest to students. One interviewee indicated this in the following terms: "They work hard, they concentrate, and you can see that everyone is concentrated and putting much effort on that. You can see that everyone is interested and want to contribute" (Ingenzi). Five, all interviewees show the importance of complex tasks in regard to enhancing understanding, integration, application, use and contextualization of knowledge. During interview, it was clear that participants frequently use the terms: integrate / integration of knowledge (nine times by Imanzi) apply /application of knowledge (used 18 and four times respectively by Imanzi & Imena), use of knowledge (15 times by Imanzi). Ingenzi said that scenario are used to "stimulate a student to link what is in theories and what is on ground". For him, scenario are important to allow students related the content to the context outside the classroom. When asked why they use complex tasks in their teaching, participants' answers were related to understanding, integration, application, transfer, exploration. One participant indicated that complex tasks are important in regard to help students deepen and extend their understanding of content, develop practical knowledge and skills- application & contextualization as well as attitude / behaviour- ability to behave in a given situation (Imena). Additionally, complex tasks are seen as important in regard to deepening and applying knowledge. "The idea of task is to reinforce the knowledge, but also to apply knowledge" (Imanzi).

Designing and use of complex tasks

To understand how teachers participated in the study use complex tasks in their teaching, it deemed necessary to ask them what they consider when designing and how they use complex tasks in their teaching. When asked what they consider when designing complex tasks, participants indicated that learning outcomes, context of students and purpose of the task are taken into consideration. Data shows that all participants show that they are guided by learning outcomes to design complex tasks. In addition to learning outcomes, interviewees indicated that context in terms of real life situation is considered when designing complex tasks. One Interviewee expressed this in the following terms: “I try to find out a well-known situation related to content and learning outcomes, from media, from newspapers and I introduce that situation at the end” (Imena). In regard to purpose, Imanzi indicated that complex task is designed in such a way that it enhances participation of students, understanding and application of knowledge. “The task must be such that […] that they can all participate” […] the idea of task is to reinforce the knowledge but also apply the knowledge” (Imanzi).

Interviewees indicated that they use complex tasks in teaching-learning process as well as assessment. They reported that complex tasks including different forms of working with texts (exegesis, critical reading and writing), case studies are used both in the process of teaching-learning and assessment. For example, one participant indicated that in-class essays are used when teaching and then appear in the final exam (Imanzi). The same interviewee reported to use critical analysis of scientific articles are used during teaching and students are asked

to select, read and criticize scientific articles in a final paper considered as final exam. Additionally, Ingenzi also reported that she uses case studies in teaching process and in exam.During interviews, participants reported challenges they encounter when using complex tasks as well as strategies to overcome them. In following sub-chapter, I present challenges indicated by interviewees when using complex tasks as well as strategies adopted to overcome them.

5.1.4 Challenges related to the use of complex tasks

From the data collected, interviewees indicated that they encounter challenges when they use complex tasks. Teacher-, student-related, institutional and contextual are described.

Teacher related challenges

During interviews only one participant was direct and open to explain challenge encountered when developing complex tasks. For other two, question about challenges to use or develop complex tasks was answered by sticking either on student-related, contextual or institutional challenges. Imanzi indicated that they are challenged by elaboration of complex tasks in regard to content and time. With regard to elaboration, one of interviewees shows that she is challenged by framing the task. She expresses her concerns as follows: “The challenge is to think in terms of how you integrate the information and how the students can apply that information. The challenge is to understand where students are and how they are going to be using this. […] so for me, the challenge becomes always framing the assignment in a simple and straightforward enough way that the students understand what the assignment

is and can do it". For Imanzi, developing complex task requires reflection on the content, level of students as well as how content has to be applied. With regard to time, Ingenzi indicated that developing complex tasks is time consuming. She added that it requires enough time of concentration.

Student related challenges

It was revealed that participants show that critical thinking, lower level of reading culture, language barrier and irresponsibility are major challenges that hinder the effective use of complex tasks in their teaching. First, it was stated that teachers face a challenge of students who are not able to think critically. This regard the capacity to reflect on the transferability of the content to different contexts (Imanzi). In this direction, Imena also shows that the main challenge is that students do not go beyond what they are given by the teachers.

Second, low level of reading culture is a challenge to the process of using complex tasks. "They do not read, and even when you engage them in reading […] exercises, they become slaves of what you give them. Only what you give them" (Imena). For Imena, habit of reading is limited among students. In addition, he mentioned that when they are asked to read, students tend to reproduce what they heard from the lecturer. In addition to limited critical thinking and lower level of reading culture, interviewees show that poor mastery of language of instruction "English" on the side of students is a challenge for using complex tasks. All three interviewees show that students do not master English used as medium of instruction and this inhibits effective use of complex tasks. For Imena, questions are asked in English not Kinyarwanda and due to poor

language skills students are not able to recall even basic knowledge previously learnt. Language as a challenge was reported by Ingenzi in terms of students' limited capacity of expression in English. During the interview, it was reported that translation is used as one of strategies to overcome language. However, Ingenzi indicated that translation as strategy becomes another challenge to time management especially in the classroom having diversity of languages.

Fourth, results of the study show a challenge related to students' responsibility. In this perspective Imena said: "if you don't follow them now, they are not really responsible to that […]". For the interviewee, students do not take responsibility of their learning. The following describes the institutional challenges.

Institutional challenges

So far as institutional challenges affecting the use of complex tasks are concerned, lack of systematic and strategic academic planning, lack and insufficiency of teaching and learning facilities, and big class are seen as challenges by participants. One of the participants shows that is not always easy to prepare a course for example when enough time is not given. "One of the challenges is planning ahead in courses. Because I don't know if I am going to be teaching something in advance, it is difficult to prepare […] For instance, if I am told that I need to be teaching something and I've never taught before and I am given two weeks to prepare it […]"(Imanzi). For the participant, effective teaching in general and particularly the use of complex tasks need preparation.

All interviewees indicated the lack and insufficiency of teaching and learning facilities as one of the challenges

hampering the use of complex tasks. Ingenzi indicated that sometimes students need printed texts for reading and analysis and yet printers are not functioning. Another challenge is related to books. “So my challenge always is to provide resources. For instance, I taught a course on English literature. Well, there is no English literature book here” (Imanzi). For Imanzi, it was not easy to teach literature where students have to be engaged in reading without books. Data collected shows that all interviewees see big class as challenge to effective use of complex tasks. Challenges are observed in regard to provision of individualised feedback, presentation of different students’ individual or group works and assessment. Two participants (Imanzi & Imena) indicated that it is not always easy to provide individual feedback for students’ works in big classes. Imena indicated that the challenge of big class is coupled with time allocation especially 40% of teaching (contact hours). For the Interviewee, allocating 40% to contact hours in combination with overcrowded classrooms is not enough to support students since group works for example are not presented. So far as assessment is concerned, Imanzi showed that overcrowded classrooms hinder individual assessment fearing to mark many copies.

Contextual challenges

During interview, Imena indicated that inaccessibility to internet and poverty of students hamper the effective teaching and use complex tasks. For him, teachers and students need to continue interacting. However, he reported that some students come from remote areas without internet and are not able to financially use other means of communications.

When conducting interview, Imena indicated that challenges are combined. Here, I refer to what he said: “Not only one factor, but it’s a combination”. After presenting challenges interviewees reported to encounter when using of complex tasks, participants indicated strategies they use to overcome them.

5.1.5 Strategies to overcome challenges

Participants used strategies to overcome the challenges. In this section, these strategies are described in relation to the perspectives that participants used to explain their strategies. I described the strategies to overcome institutional and student-related challenges reported by interviewees.

When face the challenges of lack and insufficient of teaching and learning resources, participants indicated they use their own means to find resources they need to use in their teaching. Due to lack of books to use in her courses of English literature, Imanzi took time to find texts through internet and printed them to allow students have texts to read. Unsustainably, Ingenzi once bought flipchart for her teaching. However, she found that she is not financially able to do that for all classes.

With regard to management of big classes especially failure to provide individualized feedback, collective feedback for the whole class or group (Imanzi & Imena) is adopted. For assessment, Imanzi said: “One ways of managing it [assessment in big classrooms] is that if I have them work in groups of four and they write an assignment, then I am grading one instead of four […]”. For Imanzi, assessment through group work is preferred to reduce the numbers of copies to correct in the context of overcrowded classes.

With regard to student-related challenges, interviewees reported to provide students with progressive tasks to enhance critical thinking. With regard to low level of reading, two participants indicated that they engage students in reading works followed by assessment as means to check if they really read (Imena & Imanzi). With regard to lower mastery of the language of instruction, all participants indicated that they allow discussions or translation in students' mother tongue and / or other languages, which might be easier to one or another student. Imena indicated that he allows mixture of languages in his teaching: English, Kinyarwanda and French to help students get an understanding of the content in order to apply it in real life context. After describing the findings of the study, I synthetize the major findings of the study under summary of results.

5.2 Summary of results

In this section, I synthetize the results of the study regarding the implementation of cognitive activation by complex tasks. Specifically, findings showing how interviewees cognitively activate students, use of complex tasks, challenges encountered as well as mitigation strategies are summarized hereunder.

With regard to how teaching staff cognitively activate students, data shows that all interviewees do not have an understanding of teaching as activation and teacher as activator. Additionally, cognitive activation methods reported to be used, apart from one interviewee who indicated that she uses a variety of methods, are related to specific subject related methods. For example, exegesis requests to read, understand the text, interpret and then contextualize it. Teaching language always requires

teachers to teach a grammatical rule and then ask students to use it in different sentences. Moreover, writing essays and reading exercises are all parts of language teaching. Though interviewees understand that students have to participate in the teaching-learning process and apply acquired knowledge to students' real life experiences, it is revealed that teachers participated in the study have a very limited theoretical understanding of cognitive activation and then related methods.

So far as using complex tasks in their teaching is concerned, data especially examples of tasks and understanding of complex tasks shows that participants are aware of the concept of complex tasks, their importance in teaching and limitedly use them in teaching process and assessment. Furthermore, interviewees have an understanding of cognitive requirement for dealing with complex tasks. In terms of characterizing complex tasks, data shows that interviewees consider only two aspects namely learning outcomes and context. Data shows that levels of competences and responsibility of students are not reflected by interviewees as regard to what they consider when developing complex tasks. The two aspects might be difficult for interviewees when developing complex tasks. Additionally, data shows that interviewees have implicit theoretical understanding to explicitly relate complex tasks to competence, terms which include understanding, integration, application, transfer, problem solving skills, contextualization of knowledge and critical reflection, exploration, which are closely linked to competence and specifically competence-based teaching.

With regard to challenges interviewees encountered when using complex tasks, the following results are drawn from

data collected. Data shows reluctance on the side of interviewees to report personal challenges related to using and developing complex tasks. It was easy for interviewees to easily report challenges related to students, institution and context. One reason for this may be that it is not easy for teachers to get engaged in self-reflection as regard to personal challenges encountered and reflection on their teaching. Additionally, data collected revealed that developing complex tasks for teaching staff participated in the study is still difficult for teachers participated in the study.

From the data collected, it is revealed that use of complex tasks can be challenged by other factors than teacher-related ones. Data shows that students' readiness, input factor such as facilities and other aspects of quality teaching such as feedback and assessment hinder the effective use of complex tasks in the context of this study. Data shows that it is not easy to use complex tasks in the context of students' low level of critical thinking, reading, responsibility and limited command in language of instruction. With limited capacity to critically think and read combined with language barrier, it is not easy for engaging students in higher order thinking. Additionally, with limited sense of responsibility, it would be hard for students to autonomously engage in deep reflection and exploration necessary for doing complex tasks. Moreover, data shows that the process of using complex tasks in teaching can be affected by other aspects of teaching such as feedback, assessment and overcrowded classrooms.

In nutshell, the study at hand led to the following results. First, teachers participated in the study have limited theoretical understanding of cognitive activation and

then cognitive activating methods. Second, though they use some complex tasks in their teaching, they are not able to reflect on them in light of what makes a task to be complex task. Third, it still difficult for teachers participated in the study to successfully develop complex tasks. All the above show that cognitive activation by complex is limitedly implemented in Rwandan higher education in the case of this study. Four, students' readiness in terms low levels of critical thinking, reading culture, responsibility and language, big classes and limited teaching facilities affect the effective use of complex tasks in Rwandan higher education in the case of this study.

After describing data and showing the results of the study, the results are discussed in light of discourse hereunder (chapter 6).

6

DISCUSSION

In this chapter, I discuss the contribution of the intervention to my research probelem. The purpose is to discuss the findings in the context of the scientific discourse on educational quality. As it was described in chapter four, the present study was based on controlled intervention followed by empirical research. A two days (with one day on the topic) intervention was organized for teaching staff on one Rwandan higher learning institution on cognitive activation by complex tasks. In my reflection, I briefly recall the major results of intervention and research, explain the main perspectives in which the results are discussed and then reflect on the results in the light of educational discourse.

The development of the intervention shows that trainees are aware of the dimensions of educational quality, criteria of quality teaching, competency-based teaching, cognitive activation and complex tasks as well as how they are interrelated. Additionally, complex tasks have become one of frameworks that influence the choice of tasks in teaching and assessment. The intervention was implemented on the basis of the criteria of quality teaching (Kanter et al., 2013; Meyer, 2013; Hattie, 2012; 2009; Dean et al., 2012). In addition to other active and participatory methods, trainees

were cognitively activated through different complex tasks during the development of the intervention (Chapters 3.1 & 4). Analysis and development of complex tasks, individually and collaboratively introduced trainees to the process of reflecting on tasks to be given to students in light of characteristics of complex tasks. As indicated in chapter 4, the intervention was later followed by empirical research to investigate how trained teaching staff implement cognitive activation by complex tasks in their teaching. Results of the study have shown that teachers reported to limitedly use cognitive activation including complex tasks but are unable to reflect on the most important characteristics of complex task-levels of competencies and responsibility of students. Moreover, it was revealed that it is still difficult for teachers to develop complex tasks. The above findings reveal that there is limited implementation of cognitive activation by complex tasks among selected teachers in Rwandan higher education.

Due to the newness of the high cognitive activation by complex tasks in the context of Rwandan higher education, the intervention was implemented as means of bringing about change in teaching practices in Rwandan higher education. Training is part of teacher professional development and it always necessitates to introduce change in knowledge, beliefs, attitudes and then practices of teachers (Joubert & Sutherland, 2009). I therefore discuss the limited implementation of cognitive activation by complex tasks in Rwandan higher education in three perspectives: teacher professional development in relation to quality in-service teaching training and support for teachers to implement change, change process as well as transfer of training.

6.1 Reflection in regard to teacher professional development

As the results show there is limited implementation of cognitive activation by complex tasks. The limited implementation of cognitive activation by complex tasks could be explained by quality of intervention and contextual factors of model of teacher professional development (Lipowisky & Rzejak, 2015 & Lange, 2016 adapted from Lipowsky, 2014; 2010). The model shows that the success transfer of the innovation –acceptance, understanding & beliefs, practice and students' achievement- is influenced by quality of the training, trainer's and trainees' characteristics, perceived importance of the training and school context. Without disregarding other factors, quality in-service teacher training as part of the professional development and continuous support for teachers after the introduction of innovation appear to explain more the results of the study at hand. I first discuss the results of the study in light of quality criteria of in-service teacher training and then continous support for teachers.

6.1.1 Reflection on the in-service teacher training

Basing on the fact that the results of the study showed a limited implementation of cognitive activation by complex tasks, there is necessity to critically reflect on the intervention process in light of quality criteria of in-service teacher training. Lipowsky & Rzejak (2015) and Lipowsky (2004) present criteria for an effective in-service teacher training. According to him, quality in-service teacher training focuses on one aspect of quality teaching. In regard to the training, the focus of the intervention was on cognitive activation by complex tasks. Additionally, sustainability and implementation in regard to enough time, which would allow

trainees to learn and have opportunity to implement during the training. Moreover, feedback, professional learning community, conducive learning environment, examples of good practices, linked to teachers' work (subject related), good teaching and changing beliefs are to be taken into consideration when implementing in-service teacher training. Without disregarding other aspects, I reflect on three criteria - sustainability, implementation and change of beliefs, which might explain why teaching staff participated in the intervention limitedly implement cognitive activation by complex tasks. First, the time allocated to the training was not enough for trainees to learn and implement the concept of cognitive activation by complex tasks. Empirical research shows that one short time training is likely to lead to imperfect implementation (Smith & Gillespie, 2007: 2016). Though correlation between duration of the training, amount and types of changes is not always positive, short time training may result is insignificant changes among participants (Lipowsky & Rzejak, 2015; Smith et al., 2003). When time is too short, it does not allow trainees to practice and reflect on the content of the training as well as their previous practices (Lipowsky & Rzejak, 2015: 32). Due to limited duration of the intervention, trainees were given opportunities but limited to reflect and practice acquired knowledge on cognitive activation by complex tasks. Trainees analyzed and developed complex tasks. However, one task was not enough for deepening the concept of complex tasks and necessary competencies to develop them.

This leads us to the suggestion that to be sustainable, in-service teacher training takes into account beliefs of teachers attending the training (Lipowsky & Rzejak, 2015; Lipowsky, 2004). Changing beliefs is a complex

process taking much time (McDonald, 2014; Fullan, 2011). Teachers' beliefs about teaching are built over years based on experiences. Changing them cannot be an issue of short time; it takes time to accommodate new beliefs. If research shows that transmission-led teaching dominates Rwandan education system (Mbabazi, 2013; Rwanamiza, 2011; Mugisha, 2010) and the fact that teachers mostly teach as they were taught (Verspoor, 2008: 220), teachers without pedagogical training have developed beliefs about teaching during their learning. Though teachers were actively involved in different activities, one day is insufficient to change over-years built beliefs about teaching. In addition to the quality of the intervention, which needs to be deeply reflected for the success of the innovation in the context of teacher professional development, mechanisms to support teachers after the introduction of the innovation appears to be of great importance. I then reflect on the results of the study in light of how teachers are supported to implement the innovation.

6.1.2 Reflection on continuous support for teachers

Continuous support training is important for the success of implementation of change (Ha, Sum & Chan, 2010; Fullan, 2006; Guskey, 2006; Smith et al., 2003). Follow up, feedback for the progress of implementation, and professional learning communities help to support teachers to overcome innovation related challenges (Borko, 2014; Creemers, Kyriakides & Antoniou, 2013; Hemprely et al., 2007 Guskey, 2002). Through continuous support, trained teachers can be supported in one aspect or another; they can share successes and challenges encountered in their implementation of the innovation through learning communities.

If the findings of this study teachers reported that they use complex tasks but have limited knowledge to reflect on the tasks provided; any support would have helped them develop their knowledge in regard to complex tasks. In the context of the intervention (chapter 4), the follow up was done once with three lecturers by discussing how they implement cognitive activation by complex tasks. Reflection on how teaching staff is supported after training by both trainers and academic leadership is needed in the context of Rwandan higher education. The continuous support is important in order to support the teachers to implement the innovation. Research shows that teachers, especially experienced ones, have built beliefs about teaching (Guskey, 2002: 382-385) and it not mostly easy to change. As this seems to be a crucial aspect in regard to change, the following section reflects on the findings in light of change process.

6.2 Innovation in regard to process of change

In addition to the aforementioned discussion in regard to the reflection the intervention in light of quality criteria of in-service teacher training, another perspective seems to be interesting in regard to the results. The limited implementation of cognitive activation by complex tasks in Rwandan higher education after three months of its introduction can be understood by the process of change in education especially among teachers. In the context of teaching, any innovation aims at changes at different levels: teachers' understanding, attitudes, beliefs and practices in the classroom and then students' achievement (Borko, 2014; Fullan, 2006). Research shows that change among teachers is more gradual, difficult, complex and time-consuming (Borko, 2014; Shen, 2008; Smith & Gillespie,

2007; Guskey, 2002). Teachers have to abandon their past habits, which necessitate new tasks to learn to which extent certainty of success is not assured (Zimmerman, 2006; Guskey, 2002). Most of the time people are not aware of their habits. It might then be difficult to change habits, which might have been developed over years. Trying new practices to which teachers do not have evidence that they can improve their teaching becomes a hindrance for accepting and implementing change (Guskey, 2006; Fullan, 2006). In this context, conceptual change is necessary to reject or accommodate new knowledge and skills into existing repertoire (Mällinen, 2007: 42-49).

To effectively implement cognitive activation by complex tasks, there is need of change in terms how teachers understand teaching in terms activation embedded in constructivist theories of leaning (Le Donné et al., 2016; Fullan & Longworthy, 2014). Implementation of cognitive activation by complex tasks necessitates additional time for preparation (Le Donné et al., 2016: 14).

In additional to conceptual understanding, high cognitive activation requires additional effort and time in terms of preparation. Instead of only preparing content, cognitive activation by complex tasks necessitates preparation of complex tasks (Hui & Yi, 2017; Kunter et al., 2013 & Merrill, 2002). In addition to time, development of complex tasks is demanding (Hougveld, 2003) in regard to types needed to be used as well as integrating characteristics of them in the teaching approaches (Le Donné et al., 2016; Senn & Marzano, 2015; Herrington, Lomdardi, 2007; Merrill, 2007). The effective implementation of cognitive activation by complex tasks requires a complexity of change on the side of the teachers. The findings were collected only after

three months of the intervention. Moreover, the data were collected during the very early phase of implementation of cognitive activation. With reference to complexity of change especially in the context of teaching, it is not easy for teachers to effectively implement an innovation just in such a short time. Innovation needs change of mindset which commend the understanding and habits. This is only possible through opportunities of reflection, through which existing conceptions and habits are confronted with new knowledge and practices. Change involves learning processes accepted by implementors. In the context of teaching, when innovation is introduced, teachers go through a process of learning and later transfer the skills and knowledge acquired. In the following section, I reflect on the results of the study in light of the discourse on training transfer.

6.3 Innovation in regard to transfer of training

The limited use of complex tasks by interviewed particpants might be related to training transfer. Transfer of learning regards the application of acquired knowledge and skills to similar or new contexts (Barduin,1988: 63). The training transfer regards the capacity of genelarization of knowledge and skills from the context in which they are acquired to other contexts (Lipowsky &Rzejak, 2015; Vialle, Lyasaght Verenikina, 2005). In the context of training, transfer is related to application of training knowledge and skills to working context (McDonald, 2014: 1570). From awareness to practice, the individual needs to go though a process of learning, which enables her / him to accommodate the new innovation into existing conceptions and then practices. The process requires more time and effort from the implementor of the innovation. Transfer of innovation

is not spontaneous, it is difficult and takes time. As as process of learning, transfer requires individual reflection if change has to take place (McDonald, 2014 & Saks & Becourt, 2006). Reflectivity and reflexivity are important in the process of trainfer of training. Without self-reflexivity and reflection on own habits, acquired knowledge and skills may remain unapplied. Transfer of training requires also time and effort to integrate and contextualize knowledge and skills acquired. The process requires individual motivation and self-efficacy (McDonald, 2014: 1576) to energize the effort and will to engage in learning process. Though interviewees show that cognitive activation by complex tasks is important, the effective implementation requires effort and self-motivation to deepen the content and practices on the side of teachers.

Additionally, transfer can be difficult depending on the complexity of teaching; to overcome the difficulty the creativity on the teachers is a must (Dean et al., 2012; Vavrus et al., 2011). Limited implementation of cognitive activation by complex tasks might be related to the transfer process, which is painstaking. Though the study showed some aspects of the ongoing transfer, the dimension in the teacher training in Rwandan higher education needs further reflections.

In a nutshell, the discussion of findings leads four dimensions as basis for further reflections in regard to teacher professional development in higher education. First, the duration of the training is an issue to consider when planning and implementing teachinr training. Second, teacher training aims at change (Fullan, 2006; Guskey, 2006) including conceptual change, habits, attitudes, beliefs and then practices which do not occur over night

(Smith & Gillespie, 2007; Mällinen, 2007). Therefore, it is necessary to allow trainees time to implement and confront their previous knowledge and experiences with acquired knowledge and skilss. Third, transfer of training may need not only time but also support for expert trainers, sharing successes and challenges (McDonald, 2014; Guskey, 2006). In thi regard, professional learning communities may engineer this process. Four, transfer is an issue which needs to be scienfically investigated in order understand at what extent acquired knowledge and skills are used in teaching practices. In conclusion, short time training, complexity of change and lack of ongoing support for teachers to implement innovation can partly justify the limited implementation of cognitive activation by complex tasks in the context of Rwandan higher education.

After discussing the results in light of discouse, I now turn to the conclusion in which I first give a summary of the findings then the implications of the study.

7

CONCLUSION

The study on cognitive activation by complex tasks in Rwandan higher education was undertaken as a reaction to the problem related to absence of clear policies about in-service pedagogical training which leaves the ground to the persistence of transmission-based and rote learning which have for consequence poor competencies among graduates (Chapter 1.1). As the concept of cognitive activation is new in the Rwandan higher education, empirical study was anticipated by a controlled intervention i.e. teacher training on cognitive activation by complex tasks for teaching staff in one Rwandan non-governmental higher learning institution. The empirical study was carried out to investigate how selected teaching staff implement cognitive activation by complex tasks. Specifically, the study sought to answer three research questions related to how teaching staff cognitively activate students, use complex tasks as well as challenges encountered when using complex tasks in their teaching. Data was collected from three participants selected among teachers who attended the training using semi-structured interviews and analysed with content analysis.

With regard to how teachers cognitively activate students, it was found that teachers, despite the limited

theoretical understanding of cognitive activation, limitedly and implicitly use cognitive activation methods in their teaching. Additionally, the findings of the study show that participants use complex tasks in their teaching but have limited knowledge to reflect on the concept of complex task. The findings of this study show that participants consider only real life relevance and learning outcomes as framework characterizing complex task. However, reflection on types and levels of competencies and responsibility remain challenging when reflecting complex tasks. Complex tasks are linked to competency enhancement (Krogull et al., 2014; Ehlers, 2013, Kunter et al., 2013). Findings show that participants have implicit conceptual understanding of the nexus complex task-competency-based teaching. Complex task is implicitly linked to competency-based teaching through terms such as integration, transfer, application, problem solving, exploration and contextualization of knowledge.
With regard to challenges, I found that it is difficult to develop complex task like adapting the task to the level of students, the content and the context of application. Additionally, the implementation of cognitive activation by complex tasks face difficulties already existing in the education system. Among many other difficulties, the absence of critical thinking, reading capability, responsibility and language among the students was found to be one of the most important challenge for using complex tasks. Moreover, absence of adequate institutional facilities such as library, classrooms and staff and overcrowded classes affect the implementation of cognitive activation by complex tasks in Rwandan higher education.

In nutshell, the intervention and then empirical research on cognitive activation by complex tasks, whatever small, was

introduced in Rwandan higher education as a contribution to educational quality development. Teachers implicitly and limitedly use cognitive activation methods including complex tasks in their teaching. Complex task has become one of the frameworks, through which tasks to be given to students are developed and assessed. However, its implementation is facing two main challenges. First, the theoretical understanding and the knowledge of cognitive activation and complex tasks are still limited. Second, it is challenged by above mentioned difficulties in Rwandan higher education system, which need further reflection in both praxis and research. With regard to the practice, the empirical findings show that teachers who participated in the study have limited understanding of cognitive activation by complex tasks. Additionally, the professional development in terms of in-service teacher training and professional learning communities are important to support teacher implementing cognitive activation by complex tasks (Le Donné et al., 2016; Burge et al., 2015). Academic leaders where the intervention and research were carried out should organize the follow up training on cognitive activation by complex tasks on extended time. Additionally, professional learning communities especially at department levels, should be enhanced to give opportunities for teachers to share, interact and collaborate, learning from one another in order to improve both conceptual and competencies to use cognitive activation by complex tasks.

The findings show that teachers have a limited understanding of competency-based teaching and yet it was introduced in Rwandan higher education since 2009 (Mbabazi, 2013; Mugisha, 2010) and lower levels of education since 2015 (REB/MINEDUC, 2015). Basing on the importance of the cognitive activation by complex tasks

in educational quality and particularly competency-based teaching, policy makers especially Ministry of education and stakeholders intervening in teacher professional development should include cognitive activation by complex tasks in the pre- and in-service teacher training at all levels of education to serve as an engine for competency-based teaching. As recommended by trainees and support by research (Le Donné, 2016; Baumert et al., 2010; Kanter et al., 2013; Hattie, 2012; 2009), cognitive activation by complex tasks is successful when combined with other criteria of teaching quality. Therefore, the faculty leadership should extent the training on other criteria of quality teaching including but not limited to individual support and classroom management.

Cognitive activation by complex tasks is important for enhancing students' critical thinking, responsibility and reading (Le Donné et al, 2016; Burge et al., 2015; Senn & Marzano, 2015). One the hand, the concept should be introduced to all HLIs to improve students' critical thinking, enhance their responsibility and language skills. On the other hand, Ministry of education should integrate cognitive activation by complex tasks as teaching principle to overcome the aforementioned challenges among students from lower levels of education. In addition to existing curricular practices to academically support students, higher learning institutions should organize extracurricular activities to support students in study skills, metacognitive skills and language. Additionally, the Ministry of education in collaboration with other education stakeholders such churches and parents' associations should collaborate to find appropriate strategies to support children in lower levels of education to get ready for higher education.

So far as research is concerned, the introduction of cognitive activation by complex tasks necessitates the change in role and engagement of students. Experiences and challenges of students in regard to the use of the concept should be examined. Additionally, the study at hand was conducted with teachers who reported what they do. However, research shows that knowledge and practice are not always correlated (Lipowsky & Rzejak, 2015). The study on the implementation of cognitive activation complex tasks in Rwandan higher education by observing its practice in classroom could shed light to the discourse on the implementation of cognitive activation by complex tasks.

As literature shows that change among teachers can be facilitated by the evidences about the impact of the innovation on students'acheivements (Guskey, 2002), empirical comparative study should be conducted to explore the relationship between cognitive activation by complex tasks and students' achievement in the context of Rwandan.

Results of the study especially limited implementation of cognitive activation by complex tasks as discussed in the previous chapter, the importance of the professional development in educational quality improvement (Vavrus et al., 2011, UNESCO, 2014; 2004) as well as the problem of the teacher professional development in Rwandan higher education, factors that might facilitate or inhibit the transfer of training among teaching staff should be scientifically investigated.

> "While challenge is one of the core ingredients of effective learning, the art is in making the challenge appropriate to the student" (Hattie, 2012: 52).

APPENDICES

Appendix I: Interview guide

Initial question
Teachers teach in different ways. I want to learn from colleagues' experiences in teaching. Could you, please, share with me how you teach?
Questions for in-depth data
• How do you plan your lessons? What is important for you when planning your teaching? Could you please help me understand this with examples? • What do your consider when preparing assessment?
• How do you get students actively engaged? • How do you help students understand and apply knowledge in your teaching?
• In teaching, some exercises are given to students, could you please, tell me what kind of exercises do you give to your students? • Could you give examples of exercises you give to students when you are teaching? • How do you prepare these exercises to be given to students? What do you consider while preparing them?
• Could kindly tell me about challenges you face in your teaching? How do you deal with these challenges? • What challenges do you face when elaborating complex tasks for your teaching? • What difficulties do you meet when using complex tasks? • How do you deal with those challenges?
Direct questions
• How do you engage students in reflecting on the content you are teaching? • How do you use complex tasks in your teaching? Why do you use complex tasks?
Final question
• Is there anything else you would want to share with me about your teaching?

Appendix II: Didactical Plan

Topic: In-service teacher training on high cognitive activation by tasks for Rwandan higher education academic staff

Institution: Protestant Institute of Arts and Social Sciences (PIASS)

Date: 21-22.2.2017 Place: PIASS-Huye campus

What	How	Material	Who	How long	Total time	Mode-rator
Arrival of participants & Registration Welcome Opening speech			Jacqueline DVCA VC	 5 10	8.00 8.40 8.45	DQA
Objectives and overview of the training	**Expectations:** participants write down their expectations individually. **Flashlight:** participants give their expectations to be written on the whiteboard. ***Objectives of the training:*** presentation of objectives and related content using problem-objective analysis as well as timetable.	Notebooks (part.) PPP	Emmanuel Edouard	5 5 10	8.50 8.55 9.05	
Session one: Educational Quality: What it is and aspects						
Educational quality- Meaning and aspects	***Card query method***: Ask trainees to write their ideas about quality education on cards and post them on the wall. Basing on the ideas of participants, I will explain the aspects of quality education (input, process, context, output, and outcome). After explaining the major aspects of educational quality, participants will be given empty sheet with only aspects of educational quality. They will work in 4 groups to complete by putting indicators (each group for one aspect). After completing sheets, they will be given the sheets with aspects and indicators (UNESCO, 2004) to compare with what they would have written. In the plenary, I will guide the discussion on what each indicator means. I will insist on the difference between ***outputs and outcomes.***	Cards PPP Working sheet	Christine Participants Christine	10 5 10 10	9.15 9.20 9.30 9.40	

What	How	Material	Who	How long	Total time	Mode-rator
Session two: Competence-based teaching and criteria of quality teaching						
Competence-based teaching	***Justification of competence-based teaching:*** Referring to findings of studies conducted in Rwanda (HEC, 2015; Mbabazi, 2013) shows gaps identified among university graduates.	PPP	Emmanuel-RW	5	9.45	
	Group work: *What do you understand by competence in the context of education? What teaching methods used to enhance students' competences?* Participants will be asked to answer the questions in groups of 4 members.		Emmanuel-RW	15	10.00	
			Participants	15	10.15	
	Group presentation: Each group will present what they discussed on one aspect: Meaning of competence, competence-based teaching methods.	Manilla paper & Flipcharts	Emmanuel	13	10.28	
	Input presentation: Completing what participants would have said on meaning of competence. Introducing levels of competences through some models such PISA (Reading), Muller's pyramid of competences and National Qualification Framework guiding module description in Higher education of Rwanda.		Participants & Emmanuel	12	10.40	
		PPP	Edouard	10	10.50	
Quality teaching-Criteria and indicators-Overview	For competence-based teaching, reflection will be on learning outcomes, content, teaching methods, and assessment.					
	Individual reflection on levels of competences: participants reflect on the levels of competences within modules they teach.					
	Through flashlight, I will collect some participants expressing their reflection about levels of competences.					
	For quality teaching, I will introduce by showing that there are evidence-based criteria and indicators, which can serve as framework of assessing and developing quality teaching.					
	Input presentation (six criteria and indicators of Quality teaching). Before going to break, I will tell participants that the training will focus on two criteria: High cognitive activation by tasks (Emmanuel) and good learning climate (Edouard).					
Health break (10.50 min – 11.10)						

What	How	Material	Who	How long	Total time	Mode-rator
Session three: High cognitive activation by complex tasks						
Meaning of high cognitive activation	***Pair work***: Asking participants what they understand by cognitive activation. By flashlight, I will collect ideas and explain what cognitive activation means and its relation to educational quality.		Participants & Emmanuel	10	11.20	
	Individual reflection: Participants will be asked to show teaching methods that can cognitively stimulate students in the process of teaching and learning. I will explain that research shows that students learn when they are cognitively challenged by being given complex tasks.	Papers	Emmanuel	10	11.10	
Complex tasks-Characteristics	**Input presentation-** complex tasks as cognitive activating technique in teaching. I will explain the meaning of task and what characterize complex task: Given for students to learn, related to real life of students (professional or day-to-day, address different levels of competences and students work responsibly, they may need some material or help and they may produce a product. In green, they are the most important characteristics. I will also differentiate simple and complicated from complex task as well as the importance of complex tasks.	Posters	Emmanuel	Pres 15	11.30	
Analysis of complex tasks	***Group work***: Participants will be given complex tasks to analyze in light of characteristics of complex tasks presented above. I will developed complex tasks related to clusters of specialization at PIASS: languages, Theology, Education sciences, development studies, economic s and business). Four complex tasks will be given. ***Presentation:*** Each group will present the results of the analysis by showing characteristics of complex tasks present in each task. ***Reflection:*** Participants will individually tell lessons learnt from the above analysis.	Ws	Emmanuel & Participants Emmanuel Participants	15 15 10	11.40 12.00 12.05	
Complex tasks: Elaboration I	I will ask participants to elaborate of complex tasks in their respective groups (four clusters: Languages, education sciences, Theology and Development sciences).	Papers and flipcharts	Emmanuel Participants	E 40 15	12.45 1.00	

What	How	Material	Who	How long	Total time	Mode-rator
	After elaboration, two groups will present and receive comments from participants and the trainer.					
Lunch (1.00-2pm)						
Session four: Invention and reflection on the use of complex tasks						
Complex tasks: Elaboration II	***Elaboration of complex tasks:*** Each participant will be asked to develop one complex tasks drawn from taught courses. ***Mutual feedback:*** Each participant will be asked to find a partner for mutual feedback. ***Plenary:*** One participant from each stratum will present by showing the task developed and characteristics of complex tasks within the same task.	Papers	Participants Participants and Emmanuel	40 10 20	2.40 2.50 3.10	
Use of complex tasks: When & strategies	***Group work:*** Reflection on when and some strategies of using complex tasks in teaching and learning process. Ideas are collected through flashlight. ***Reflection:*** Participants will be given sample of final examination papers and analyze them (two per group). During the analysis, they will see if there are complex tasks and what can be improved.	Ws	Participants & Emmanuel	15 10	3.25 3.35	
Homework	***Homework:*** participants will be given a homework of elaborating one complex tasks from modules he / she teaches at PIASS	-	Emmanuel Participants	5	3.40	
Closing: Announcement prayer	I will thank participants, give the announcement for the next day and closing with prayer.	-	Moderator	5	3.45	
Evaluation of the day	Ask participants to put the sign x for his or her appreciation about the training on the flipchart: Content, methods, relevance, applicability (smiles). This will be done after closing prayer when participants will be getting out of the training room.	Flipchart	Emmanuel & Participants	5	3.50	
Second day 9th February, 2017						
Revision of the first day	***Individual work:*** Reflection on what was important and share with others in plenary through flashlight.	Papers	Participants Emmanuel	10	8.40	

What	How	Material	Who	How long	Total time	Mode-rator
Homework on elaboration of complex tasks and plenary session	***Presentation:*** two complex tasks by two volunteering participants and give them feedback from participants and trainer. After, there will plenary session where participants will share reflection about using complex tasks in teaching at higher education level.		Participants	25	9.05	
Session seven: Good classroom learning climate for quality teaching						
Meaning of good learning climate and its indicators	***Individual reflection***: The participant will describe individually the climate of classroom they enjoyed during their studies. By **pair exchange**, the participants will share their experience and then by flashlight, some will share with in plenary with whole participants. ***Input Presentation***: I will explain the meaning of learning climate in class and give overview of different good learning climate indicators (Justice, respect, high expectation, responsibility, responsibility, laughing and transparent standards of assessment)	Papers PPP	Participants Edouard	15 30	9.20 9.45	
Reflection on Indicators of good classroom learning climate (Justice, respect, high expectation, responsibility, laughing and transparent standards of assessment)	***Group work:*** I will divide the trainees into six groups to work on indicators of good learning climate. Each group will reflect on one indicator of good learning climate- show the characteristics and how this indicator can be developed in classroom. Gp 1: Justice on the side of teacher towards students and on side students to students. Gp2: Respect on the side teacher towards students and on side students to students Gp 3: High expectation Gp 4: Responsibility Gp 5: Transparent standards of assessment Gp 6: Laughing ***Group presentation***: each group will post its work on the wall and then each group will visit the posters of other groups to read what other groups have done on different indicators. **Input presentation:** In order to complete what the groups have mentioned, I will present the role	Flip chart Posters PPP	Participants Edouard Participants Edouard	**30** **20** **15**	**10.15** **10.35** **10.50**	

What	How	Material	Who	How long	Total time	Mode-rator
	of and strategies to ensure good learning climate.					
Health break (10.50 min – 11.10)						
Session eight: Exercise on developing good classroom learning climate for quality teaching						
Exercise on developing good learning climate in classroom	***Individual work***: Each participant will choose two indicators of good learning climate, which appears to be the least developed in his/her teaching experience and develop different strategies he/she will use to develop it in his/her teaching classroom. After the trainer will organise a game where they will stand up and make a circle in front singing and dancing, after a particular time give a signal to make the groups depending on the number he wants and within the groups they share different strategies they have elaborated for developing good learning climate in their classroom.	Working Papers	Participants Edouard Edouard & participants	30 30	11h40 12h10	
Session nine: Development of good learning climate through communication						
Develop good learning climate by making good communication in the classroom	***A role play***: The trainer summarizing the previous content and reacting on two students' disturbances in the classroom by blaming the first and using "I message" for the second. Reflection: ask participants to analyse the two ways of reacting on students' disturbances [in pairs and plenary]. ***Input presentation:*** Why good communication, the use of "I message" to ensure good learning climate in class.	PPP	Edouard Participants Edouard	5 15 10	12.15 12.30 12.40	
Exercise on I message	***Individual working and Mutual feedback:*** Each participant will construct an 'I message' reacting on one of the following situations: charting on watsup in the classroom, student who did not do assignment, student who was absent during the last session, then shows it to his/her partner. At the end some examples made will be shared in plenary.	Papers	Participant Edouard	20	13.00	
Lunch (1.00-2pm)						

What	How	Material	Who	How long	Total time	Mode-rator
Session ten: Development of good learning climate by providing constructive feedback						
Constructive Feedback and good learning climate	**Group sharing**: The participant will share what they understand by feedback and how they provide it to students. **Input presentation** on meaning and strategies of providing constructive feedback to students as well as how it enhances good leaning climate. **Role play:** Within pair groups, each one will play a role of providing feedback to his/her partner (one will be a teacher and another a student and vice versa) on the exercise done on I message.	PPP	Christine Christine Participants	15 20 20	14.15 14.35 15.55	
Take home message	Participants will be given cards where they will write their take home message from the training. The cards will be posted on manila paper.	Cards	Participants Emmanuel Edouard	20	15.15	
Evaluation and Recommendations	Evaluation will be done in two steps. First of all, each group will be given a questionnaire to fill. And plenary sessions where the whole group will share what was appreciated and areas for improvement for future teacher training. We will end by thanking participants.		Participants	25	15.40	
Closing remarks Prayer			VC	10	15.50	

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Abstract

After significant improvements regarding the access to higher education in Rwanda, educational quality remains a problematic issue. A clear imbalance between competences of graduates entering the labour market and job requirements from the employers continues to be a persisting problem. Teaching methods are one key factor to tackle this problem. This study examines the potential of cognitive activation by complex tasks as means of enhancing students' competences. Based on the findings of teachers' limited theoretical understanding of the concept and related methods, the study recommends greater emphasis on cognitive activation by complex tasks in pre- and in-service teacher training as well as teaching practice at all levels of education.

Résumé

Après des améliorations significatives concernant l'accès à l'enseignement supérieur au Rwanda, la qualité de l'éducation reste problématique. Un déséquilibre évident entre les compétences des lauréats entrant sur le marché du travail et les exigences des employeurs en matière de travail reste un problème persistant. Les méthodes d'enseignement sont un facteur clé pour résoudre ce problème. Cette étude examine le potentiel d'activation cognitive par des tâches complexes comme moyens de développer des compétences des étudiants. Les résultats montrent que la compréhension théorique du concept ainsi que la connaissance des méthodes y relatives par les enseignants sont limitées. L'étude recommande de mettre l'accent sur l'activation cognitive par les tâches complexes dans la formation initiale et continue des enseignants ainsi que la pratique d'enseignement à tous les niveaux d'éducation.

Emmanuel Niyibizi is a researcher and teacher educator at PIASS-Rwanda. In 2018, Mr. Niyibizi has been nominated as the Director of the Centre for Didactics and Research in Education. In his position, he has initiated different scientific projects including but not limited to the action research on teacher professional learning and teaching quality in Rwanda. His research interests are educational quality with focus on teacher education and teaching; inclusive education and teacher professionalization. He is currently pursuing his doctoral studies at the Bamberg Graduate School of Social Sciences (BAGSS) - University of Bamberg, Germany on *"Teacher educators' subjective theories about quality teaching in Rwanda"*.

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