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Verification of the basic competences developed in physical sciences by 7th and 8th pupils in the schools of Lubumbashi

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Abstract
This article presents the situation of the teaching and the training of sciences (physics and chemistry) at the pupils of the Final Cycle of basic Education.
This article is particularly interested in the teachers responsible for the course of physical sciences and technology in the cycle and the basic skills developed by the pupils of 7th and 8th of basic education in the subdivision Lubumbashi I. It begins by presenting the proportion of teachers having followed the training centered on the Situation-Based Approaches (SBA) and that of the pupils evolving/moving in schools which implement the SBA. It is also interested in the descriptive data drawn from the questionnaires concerning four fields of information: 1) The construction and implementation of learning situations 2) the effective application of APS 3) the organization of the class into groups of students 4) social interactions between students in working groups. The article also examines the relationships between the development of skills and the variables of these four fields.
The purpose of the article is to verify among the basic skills defined in the programs of the fields of science learning by the Ministry of Primary Secondary and Technical Education in the DRC, those which are developed by the pupils of the final cycle of the basic education in the physical sciences and more particularly in the discipline of chemistry.

Keywords: physical sciences, pupils, competences developed

1. Introduction

The Ministry of Primary, Secondary and Technical Education of the Democratic Republic of Congo has always made great efforts to ensure that Congolese learners have access to effective and good quality education, but effective education is one that allows learners to use the essential disciplinary knowledge learned at school in order, on the one hand, to deal with the usual situations of daily life and, on the other hand, to successfully continue the school curriculum.

To achieve this and in its constant concern to provide primary and secondary school teachers with quality educational tools, the Ministry of Primary, Secondary and Technical Education has just updated the Secondary Education Program more especially the field of science. This update was dictated by the concern to adapt this tool to the scientific, historical, pedagogical and socio-cultural innovations of the moment. The current program reform is centered on the situation-based approach. Because as we know, in general, a student develops his skills by dealing with situations (Service National de Formation, 2019) [12].

Kasanya and al (2022) [4] concluded that the lack of qualified science teachers had a negative impact on the development of basic skills and the choice of the science option by 7th and 8th graders in Lubumbashi schools.Given the multiple constraints relating to the use of the situation-based approach in the classroom (Meq, 2002) [12], its general and automatic implementation requires that certain essential prerequisites be met, in terms of capacity building of human resources, adequate equipment and infrastructure to guarantee the expected efficiency of both teaching staff and students, the main beneficiaries of this reform. Because its general and automatic implementation without bringing together essential prerequisites could have a negative impact on the effectiveness of the transmission of disciplinary content and on the development of student skills.

The programs for the 1st, 2nd, 3rd and 4th years of Scientific Humanities, like those of the final cycle of Basic Education, are centered on putting students into activity by dealing with situations that have meaning for them. and which call on essential knowledge to lead to the development of competences. (Programmes éducatifs du Domaine d'Apprentissage des Sciences, 2019) [10].

To develop skills, students must rely on different resources. These are ways he uses to deal with a situation. In a school context, the situations suggested must allow the student to use resources that fall within the disciplines covered at school based on international standards that describe what the student must learn (Service National de Formation, 2019) [12].

Scientific training according to the Situation-Based Approaches (SBA) serves as the basis for the informed participation of the citizen in the development of a technological society, as part of the process of permanent learning, as a preparation for entering the labor market and as an instrument of personal development of students. (Conseil économique du Canada, 1990) [1].

This article is particularly interested in the teachers responsible for the course of physical sciences and technology and the development of basic skills by the pupils of 7th and 8th of basic education in the Lubumbashi I subdivision. It begins by presenting the proportion of teachers who have taken training focused on SBA and that of students in schools that implement SBA. It is also interested in the descriptive data drawn from the questionnaires concerning four fields of information: 1) the construction and implementation of learning situations 2) the effective application of SBA 3) the organization of the class into groups of students 4) social interactions between students in working groups. The article also examines the relationships between the development of skills and the variables of these four fields.

The purpose of the article is to verify among the basic skills defined in the programs of the fields of science learning by the Ministry of Primary, Secondary and Technical Education, those which are developed by pupils in the Final Cycle of basic Education (FCBE) in the physical sciences and more particularly in the discipline of chemistry.

2. Materials and Methods

To collect our data, we carried out an investigation with semi questionnaire open and directional. This method of investigation was supported by the techniques of interview and documentary analysis.

2.1 Sites of study and Sampling

2.1.1 Sites of study

We undertook our research in the subdivision of Lubumbashi I, one of the subdivisions of the educational province of Haut-Katanga I in Democratic Republic of Congo (DRC). The reason which pushed us to retain this subdivision among so many others is the facility to reach the majority of schools being in the center of the city and its surroundings. During our pre-investigation we had counted with the complicity of the persons in charge of the subdivision 63184 pupils and 4499 teachers for all sections and confused classes. And for the classes of 7th and 8th only, we had counted 3012 pupils and 168 teachers teaching in 7th and 8th of basic education.

2.1.2 Sampling of the schools and teachers of the physical sciences and technology

The 229 schools of the Lubumbashi1 subdivision function in management modes. To make our study, during our pre-investigation, we had counted with the complicity of the persons in charge of the subdivision six management modes. To this end, each mode of management was represented by the number of schools which it contains divided by six (a number of modes), we assigned at each school a number by mode of management. After we cut and folded these numbered papers, then we carried them in a ballot box. We operated a pulling randomly. At the end, the random sampling showed the names of 38 schools selected. Curiously in each selected school, the course of the physical sciences and technology of 7th and 8th were taught by a same professor. The sample size of the teachers finally retained is 38 (with more than 89 % of teachers evolving/moving in the private schools) who constitute the small-scale model drawn from all the teachers of the subdivision of Lubumbashi I who form together the universe of investigation (the population mother). In the table1, we represent the number of schools and teachers selected by management mode.

Table 1: Sampling of the schools and teachers

Retwork	PA	NC	CC	PC	AC	KC	Total
Number of schools	206	9	8	3	2	1	229
Number	34.3	1,5	1,3	0,5	0,33	0,16	38,09
Rounded number	34	2	1	1	0	0	38

PA : Privates Approved **; NC :** Not Conventional **; CC :** Catholic Conventional**, PC :** protestant conventional**; AC :** adventist conventional **& KC :** Kimbanguist conventional.

2.1.3 Sampling of pupils

The time constraints and the reasons of convenience on the ground pushed us to retain 10 pupils per school (that is to say 5 pupils of 7th and 5 pupils of 8th). For each class we assigned with all the names of the register of call a number. After we cut and folded these numbered papers, then carried in a ballot box. We operated a pulling randomly. At the end, the random sampling showed the names of the pupils

selected. The sample finally selected is of 380 pupils (at a rate of 10 pupils per selected school) who constitute the small-scale model drawn from all the pupils of the subdivision of Lubumbashi I who form together the universe of investigation (the population mother).

2.1.4. Parent Sampling

The same time constraints and reasons of convenience on the ground led us to retain 10 parents per district of the Lubumbashi commune (that is to say 5 men and 5 women). Indeed we had during our pre-survey counted with the complicity of the leaders of the Lubumbashi commune 12 constituent districts of the commune. The sample finally retained is of 120 parents who constitute the reduced model drawn from all the parents of the Lubumbashi I sub-division who together form the survey universe (the parent population).

2.2 Statistical analysis

The asked questions offered to the respondents a choice of answers of which the number varied from four to six. The averages obtained were subjected to univariate varience analysis (ANOVA) with statistical software XLSTAT-Pro7.5.The independent variables were the studied variables and the choice of the scientific option to humanities constituted the dependent variable.

3. Results and Discussion

The results relating to the training area of the survey carried out near 38 teachers responsible for the course for the physical sciences and technology are included in table 2 below.

Table 2: Training area of teachers

Traning Fields	Options	Frequence	%
Applied pedagogy	Chemestry-physics	3	7,89
	Biology-chemestry	9	23,68
	Mathématics-physics	5	13,16
Medecine	Human	2	5,26
Faculty of sciences	Pure chemistry	3	7,89
polytechnique	Indistrial chemistry	10	26,32
	Métallurgy	5	13,16
agronomic Sciences	Foodstuffs chemistry	1	2,64
Total		38	100

The question concerning the training area was put to determine the number of qualified and not qualified teachers sample. The reading of table 2 shows that 17 out of 38 sampled teachers, that is 44, 73% only teachers are qualified and the remaining number constitutes the list of the under-qualified teachers. More than half of our sample would not ensure the teaching practices by formation but by nature and difficulties of the economic situation.

It should also be announced that 3 out of 17 qualified teachers, that is 17, 6% only are well placed to teach the course of sciences physics-technology for having known a rich career in the course of chemistry and of physics. These results corroborate those of Kasanya and al (2022) [4] who also found that only 3 out of 17 teachers taught the physical sciences course.

Table 3: Seniority in 7th and 8th grades

Seniority	Frequence	%
≤ 3years	7	18,42
3-10years	13	34,21
More than 10 years	18	52,63
Total	38	100

Table 3 presents the results relating to the seniority of teachers holding the course of physical sciences in 7th and 8th of basic education.

It appears that most of them have a seniority of more than 10 years or even (52.63%). Just by this element, we think we know that they have experience in the analysis of the educational system of children. And they could have an idea about the quality of the results obtained by the learners of the old program and that of the results obtained by the learners subjected to the new program.

Table 4: Construction of new learning situations

Construction of new learning situations	Frequence	%
Yes	8	21
No	30	79
Total	38	100

The results in table 4 reveal that only 8 out of 38 teachers (that is to say 21%) are able to construct new situations. This could be explained by the fact that their training followed was based on the criticism, analysis, construction and implementation of teaching/learning situations in science (espacially in chemistry). And therefore they easily apply the approach by situations in physical sciences and chemistry in the 7th and 8th grades of basic education.

Table 5: Provision of situations to pupils

Provision of situations to pupils	Frequence	%
No	300	78,9
Yes	80	21,1
Total	380	100

The results in Table 5 also show that only 80 out of 380 pupils (that is to say 21.1%) are subject to the requirements of the new approach in force in physical sciences and chemistry in the final cycle of education classes. This could be explained by the fact that these students would be in schools bringing together some essential prerequisites for the implementation of the situated approach. These 80 students obviously come from 8 out of 380 schools that acknowledge applying the situated approach (see Table 4). This observation also proves that the general and automatic implementation of the reform is only theoretical in several schools, in the field it is still the old approach that is applied. We have identified a relationship between the proportion of teachers able to construct learning situations and that of students who study while dealing with situations in class. [$F(3.2888)=8.0$; $p<0.001$].

Teachers capable of constructing learning situations actually succeed in making new situations available to students. This observation is identical to that of Kasanya (2022) [3] who found that only teachers whose training was based on the criticism and analysis of situations managed to build them and make them available to pupils.

Table 6: Rest of the training followed on the criticism, analysis, construction and implementation of teaching/learning situations

Rest of the training	Frequence	%
Yes	3	7,9
No	35	82,1
Total	38	100

The results in Table 6 show that only 3 out of 38 teachers, that is to say 7.9%, were subjected to criticism, analysis, construction and implementation of teaching/learning situations in science (espacially in chemistry). This could be explained by lack of funding and by the fact that the trainers of trainers were not well supervised. We have identified a relationship between the proportion of teachers subject to criticism, analysis, construction and implementation of teaching/learning situations in science and that of students who study while dealing with situations in class. [F(4.1879)=9.0; p<0.001].

Teachers subject to criticism, analysis, construction and implementation of science teaching/learning situations effectively manage to make new situations available to students.

These results corroborate those of (Provost, 1976) [11] in Canada who found that the situated approach was difficult to apply in schools that were poorly equipped with laboratories and where teachers were incapable of criticizing, analyzing and implementing situations. Teaching for lack of effective training. However, in the LMD System, all the teaching units in didactics allow the student to plan, design and manage teaching/learning situations in the first four years of secondary school (Programme de la Licence en Enseignement de Sciences et Technologie, 2019) [9].

Table 7: Difficulties encountered in dealing with similar situations without teacher support

Difficulties Encountered	Frequence	%
Difficult access to the internet to collect information	7	35
Insufficient manuals containing the information	6	30
Consuming a lot of time	1	5
Lack of material	3	15
Use of expensive teaching materials	2	10
The high cost of same objects offered in the situations	1	5
Others	0	0
Total	20	100%

Table 7 presents the results relating to the difficulties encountered in dealing with similar situations without teacher support.

Many students who have to deal with similar situations believe that they encounter many difficulties in dealing with these situations. Among them:

- 35% of pupilss mention difficult access to the internet to collect the information needed to deal with situations
- 30% of pupils mention Insufficient textbook containing the information necessary to deal with situations
- 15% of pupils mention the lack of material allowing the treatment of situations outside of school
- 10% of pupils mention the use of more expensive teaching materials that most schools and students in the city unfortunately cannot afford

These difficulties reinforce the position of the OECD (2013) [7] which urged all countries that want to apply the situated approach generally and automatically to carry out a careful assessment of the state of the essential prerequisites in terms of regulatory texts, the capacity of human resources and infrastructure in order to guarantee the expected efficiency of both teaching and administrative staff and learners, the main beneficiaries of the reform.

Table 8: Application of the Situation-Based Approaches in 7th and 8th

Application of the approach	Frequence	%
Yes	8	21
No	30	79
Total	38	100

The results of Table 8 reveal that only 8 out of 38 teachers, that is to say 21%, apply the situational approach in physical sciences and chemistry in the 7th and 8th grades of basic education. This finding sufficiently proves that the general and automatic implementation of the reform is only theoretical, on the ground it is still the old approach that is applied.

We have identified a relationship between the proportion of teachers capable of constructing learning situations and that of schools that apply the situated approach. [F(4.3235)=9.1; p<0.001].

Teachers capable of constructing learning situations and evolving in equipped schools effectively manage to implement the Situation-Based approach.

Table 9: Reasons for not applying the Situation-Based approach in 7 th and 8 th

Reasons	Frequence	%
Resource unavailability	9	30
Lack by learners of the entry profile	0	0
Consumption of a lot of time by the approach	12	40
High workforce	6	20
Others	3	10
Total	30	100%

Table 9 presents the results relating to the non-application of the SBA. It shows that 30 out of 38 teachers, that is to say 79%, give the reasons why they continue to apply the old approach to the detriment of the current approach. Among them:

- 30% of teachers do not apply the current approach due to a lack of resources (equipment, laboratory, library, etc.) allowing relevant actions in dealing with situations.
- 40% of teachers do not apply the situated approach due to the fact that the stages of the new program are so time-consuming that they cause delays in subject forecasts (delay compared to the national program)
- 20% do not apply the situational approach because there are so many students in less spacious rooms that it is difficult to organize them into groups.

The results in Table 9 corroborate those of the OECD (2013) [7] report noted above.

Table 10: Organizing students into groups

Nbre of pupils per group	Teacher frequency	%	Pupils frequency	%
2-4	0	0	0	0
5-7	0	0	0	0
8-9	1	12,5	11	13,8
10 and More	7	87,5	69	86,2
Total	8	100	80	100

Table 10 shows that more than 86% of pupils who are subject to the requirements of the new approach in force in physical sciences and chemistry in the classes of the final cycle of basic education find themselves in work groups of 10 people and more. This could be explained by the fact that many schools make students study in promiscuity due to a lack of infrastructure that can make it possible to organize parallel classes. Obviously, these students are supervised by teachers who apply the current approach while organizing learners into groups whose size is greater than or equal to 9 (see Table 8). This practice is against the recommendations of the (OECD, 2006; IEA,2019) [6,2] which requires that a group of students in class be made up of a maximum of 5 students, because the larger the group, the less work there is flourishing.

We found a relationship between social interactions between 7th grade students in work groups and the size of student groups in class. [$F(3.5986)=8.5$; $p<0.001$].

Learners in groups whose size is greater than or equal to 10 do indeed show a lot of intolerance and aggressiveness towards each other.

Table 11: Observation made regarding social interactions between 7th grade pupils in work groups

Observation made regarding social interactions between pupils	Frequence	%
Manifestation of a lot of intolerance and aggression towards each other	27	71
Work in harmony	3	7,9
Disturbance of male pupils	3	7,9
Harmony problem for pupils of the same sex	3	7,9
Others	2	5,3
Total	38	100

The results in Table 11 show that more than 70% of teachers found that 7th graders in groups show a lot of intolerance and aggressiveness towards each other. This could be explained by the fact that group work is an unusual situation for them. These results corroborate those of Tourigny (2004)[13] who found in Canada that children who are not psychologically prepared to work in groups show a great deal of intolerance and aggressiveness towards each other. Hence the need to organize awareness sessions before the start of classes in 7th grade in order to prepare them to work peacefully in a group.

Table 12: Observation made regarding social interactions between 8th graders in workgroup

Observation made regarding social interactions between pupils	Frequence	%
Manifestation of a lot of intolerance and aggression towards each other	6	15,7
Work in harmony	25	65,8
Disturbance of male pupils	3	7,9
Harmony problem for pupils of the same sex	2	5,3
Others	2	5,3
Total	38	100

After analyzing the results in Table 12, we realize that more than 65% of teachers have found that 8th graders in groups work in harmony and symbiosis. This could be explained by the fact that group work has become a habitual situation for them since 7th grade. These results corroborate those of Tourigny (2004)[13] who found in Canada that the children of the rising promotions experienced pleasure in working in a group.

Table 13: Number of pupils enrolled in 7th and 8th grade (parents)

Number of pupils in 7th and 8th	Frequence	%
0	13	10,8
1	18	15,0
2	67	55,8
More than 2	17	14,2
No answer	5	4,2
Total	120	100

After a meticulous analysis of the table13, an average of 2 children at the final level of BE emerges, that is to say more or less 2 children at the final level of basic education. Because most of the parents surveyed are over the age of 50 or even (75%) ; they are therefore older heads of households likely to have children who can go to school in 7th, 8th of basic Education, humanities or even university. The results in Table 13 corroborate those of the Osbone (2013) [8].

Table 14: Easy integration of children trained at the Final Cycle of Basic Education (FCBE) in to active community life

Easy integration of children in to active community life	Frequence	%
Yes	45	43,3
No	59	56,7
Total	104	100

It follows from Table 14 that less than 45% of parents think that children trained at the end of the FCBE can easily integrate into working life. This can be explained by the fact that the approach by situations is so theoretical that it cannot make them useful in working life. These results corroborate those of Kasanya *et al* (2022) [4] who concluded that the lack of qualified science teachers had a negative impact on the development of basic skills and the choice of the science option by 7th and 8th graders in the schools in Lubumbashi.

Table 15: Consequences of the reform

Conséquences de la reforme	Frequence	%
Highlighting lesson forecasts	0	0
Delay of material forecasts	12	31,58
Consumption of a lot of time	14	36,84
Use of expensive teaching materials	6	15,79
Make teaching more pratical	6	15,79
Others	0	0
Total	38	100

Table 15 shows that several respondents believe that the new program has more negative consequences than advantages. Among them:

- 31.58% of teachers accuse the new program of causing the delay in subject forecasts;
- 36.84% of teachers accuse the stages of the new program of being too time-consuming.
- 15.79% of teachers accuse the new program of imposing the use of more expensive teaching materials that most schools in the city unfortunately cannot afford
- Only 15.79% of teachers appreciate the practicality of the new program.

4. Conclusion

Our research titled "verification of the basic skills developed in physical sciences by 7th and 8th graders of basic education in the school of lubumbashi " has the general objective of verifying among the basic skills defined in the programs in the science-chemistry learning areas by the Ministry of Primary, Secondary and Technical Education, those developed by students in the final cycle of basic education in physical sciences and more particularly in the discipline of chemistry.

Less than 45% of parents think that children trained at the end of the FCBE can easily integrate into working life. This can be explained by the fact that the SBA is so theoretical that it cannot make them useful in working life.

The results showed that only 44.73% of teachers are qualified and the remaining number constitutes the list of under-qualified teachers. These results confirmed that more than half of teachers would not ensure teaching practices by training but by nature and situational difficulties. It should also be noted that only 17.6% of qualified teachers are well placed to teach the physical sciences-chemistry course.

Several teachers surveyed believe that the new program has more negative consequences than advantages. Among them: 31.58% of teachers accuse the new curriculum of causing the delay in subject forecasts; 36.84% of teachers accuse the stages of the new program of being too time-consuming. 15.79% of teachers accuse the new program of imposing the use of more expensive teaching materials that most schools in the city unfortunately cannot afford.

All the teachers were trained in the situated approach in the fields of science learning, but only 7.9% of them were subjected to criticism, analysis, construction and implementation of teaching/learning situations. in science (especially chemistry).

The results concerning the general and automatic application of new programs centered on the situated approach reveal that only 21% of teachers apply the approach by situations in physical sciences and chemistry in the 7th and 8th grades of the education of base. The other teachers give the reasons why they continue to apply the old approach to the detriment of the current approach. Among them: 30% of teachers do not apply the current approach due to a lack of resources (equipment, laboratory, library, etc.) allowing relevant actions in the treatment of situations; 40% of teachers do not apply the situated approach due to the fact that the stages of the new program are so time-consuming that they cause the delay of the subject forecasts (delay compared to the national program); 20% do not apply the situational approach because there are so many students in less spacious rooms that it is difficult to organize them into groups.

More than 65% of teachers indicated that 7th grade students in groups show a lot of intolerance and aggression towards each other, especially at the beginning of the year, while 8th graders in groups work in harmony and symbiosis

On the whole, we must not conclude that science teaching has failed and that new programs have contributed to this teaching, but rather that they have made a disappointing contribution to the intellectual and socio-emotional formation of learners.

5. Suggestions

It is true that taking our suggestions into account would not systematically lead to an improvement in science performance. But it will still be a step towards improving the quality of the new FTS programs centered on the SBA.

We propose to carry out a careful assessment of the state of the essential prerequisites in terms of regulatory texts, capacity building of human resources and infrastructures in order to guarantee the expected efficiency of both teaching and administrative staff and learners, the main beneficiaries of the reform.

We suggest that schools organize annual awareness sessions before the start of classes in 7th grade in order to prepare them to work peacefully in a group.

We propose to the Congolese government to get involved in limiting the number of people per class, because promiscuity transforms the school; place par excellence of instruction in vector of disease. We must think about building new schools.

Although the school has little influence on the socioeconomic characteristics of its clientele in the short term, the fact remains that in the long term, it can influence the behavior and choices of its students, and thus modify the characteristics of the population it serves. In the short term, French schools must offer a rich educational environment by providing their students with quality resources, materials and equipment. It is understood that the availability of these resources at the school is highly dependent on its budget. However, in order to achieve this objective, the school can develop partnerships with public bodies including libraries or private bodies including companies, laboratories, etc.

We propose to the Congolese state to improve the working and salary conditions of teachers, because the success of this demanding approach depends above all on the adhesion to the concept of the men and women who apply them, that is to say the teachers. Its success will largely be what the latter make of it and therefore remains dependent on their commitment.

We propose to the Congolese state to improve the working and salary conditions of teachers, because the success of this demanding approach depends above all on the adhesion to the concept of the men and women who apply them, that is to say the teachers. Its success will largely be what the latter make of it and therefore remains dependent on their commitment. It will only be achieved, whatever the means mobilized, if the way of teaching changes in the classes. Otherwise, its failure is inevitable. And the competency-based approach will only

remain a flash in the pan, an additional incident in the life of the education system. Poorly applied, the competency-based approach even risks aggravating academic failure.

This work gives the level of development of skills in physical sciences and chemistry by pupils of 7th and 8th years of basic education. It constitutes an orientation for future researchers who should consider verifying the skills developed in chemistry by 4th year students in the scientific humanities.

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