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At the beginning of this new editorial, let me first look back to the 17th International Conference on Efficiency and Responsibility in Education (ERIE 2020) that took place at the Faculty of Economics and Management, Czech University of Life Sciences Prague on June 4 - 5, 2020. Due to the COVID-19 pandemic, the year-to-year present form of the conference was replaced by its virtual form for the first time. We are glad that, during this difficult period, participants from the Czech Republic, Finland, Hungary, Italy, Mexico, Russia, Slovakia and the United States were able to share results of their research with other experts in the area. The presented topics covered diverse areas, such as theory and methodology of pedagogy and education; information and knowledge in lifelong education and training; ICT in education; responsibility in education and ethical issues in education. All the accepted articles and virtual posters of the ERIE 2020 conference, as well as conference proceedings from the previous years, are available on the conference website.

Further, SCImago has published the annual Scimago Journal & Country Rank results for 2019. We are glad to announce that, for the first time, ERIES Journal has been included in the SCImago Journal Rank (SJR) indicator. The journal is now ranked in the Q3 in the Education category with SJR of.199, ranking the journal in the 882nd position out of 1272 journals. This result is a commitment for us to keep working on the journal quality.

In the second issue of the ERIES Journal (Vol. 13, No. 2) we would like to present four articles from collective of authors from the Czech Republic, Nigeria and Turkey, whose central idea is related to teachers' and students' skills and experience in various areas of education.

The first article "Inefficiency among nonacademic staffs in Nigerian tertiary institutions: The role of training and development" from Bimbo Onaolapo Adejare, Gbemi Oladipo Olaore, Ekpenyong Ekpenyong Udofia and Temitayo Bosede Emola, aims to determine the extent to which induction, demonstration, on-the-job and formal training, which are all elements of employee training and development, enhance managerial efficiency by looking at employee productivity and quality of service delivery. For this purpose, the authors analysed responses from 293 non-academic employees in selected public universities in Nigeria. The results indicate that on-the-job training has a significant negative relationship with the service quality delivery in Nigerian universities. The authors conclude that the negative relationship could be related to the lack of communication between experienced employees and new employees. The study also demonstrates that the only way to resolve inefficiency among non-academic employees in the public tertiary institutions in Nigeria is to integrate effective training into employee career management, as well as to adopt employees' performance evaluation process as contained in the private organizations.

In the second article "Identification of crucial steps and skills in high-achievers' solving complex mathematical problem within mathematical contest", the authors Kristína Bulková, Janka Medová and Soňa Čeretková used the statistical implicative analysis to investigate 29 solutions of Mathematics B-day 2017: Arrow clocks problem. The Mathematics B-day contest aims at the upper secondary students devoted and interested in mathematics. We identified the key subtasks solutions directly related to the level of the Inquiry Based Learning competencies performed in the final mathematical investigation. The subtask which required high level of algebraic thinking influenced the level of the final mathematical investigation the most. What is more, the authors observed that the problem aiming at algebraic generalization was identified as having the highest influence and impact on the process of the solution of the open-ended mathematical problem

The objective of the third article "Indices converting resignation and drop-offs of business students to retention" from Lucie Vnoučková and Zdeněk Linhart is to discuss how to retain both business and institutional career-oriented students using real-time communication based on their attitudes and emotions resulting from logically generated synonyms by automatic data evaluation. The authors assess the likelihood for continuous matriculation in order to increase students' retention rates. The data used in this analysis came from a primary quantitative survey by means of the questionnaire investigation collected by web survey (CAWI method). The sample comprised two groups of students: 1) students who dropped off during the first month (240 respondents) and 2) students who successfully continued their studies during the first year, 295 respondents. Using statistical and dimensional analysis, four groups of students were identified among university applicants: proactive, reactive, lazy and institutional. The results indicate that business and institutionally oriented students should be separated and treated individually to increase retention.

EDITORIAL

In the last article "Problems experienced in classrooms within students from different cultures", Mehmet Hayri Sarı and Erkan Yüce used open-ended semi-structured interviews with primary school teachers to observe problems they experience in classroom contexts that involve students from different cultures (Turkish, Iranian, Afghan, and Syrian). The observed problems can be grouped into three main categories: 1) problems experienced by themselves as teachers, 2) problems experienced in terms of students, and 3) problems experienced in terms of parents. More specifically, insufficient teaching experience, time and classroom management, discipline, and insufficient foreign language knowledge are among the most experienced problems by teachers and students. The fact that teachers do not have a specific curriculum to manage the learning-teaching process in a classroom environment where different cultures coexist poses a major problem.

We would like to thank all reviewers who contributed to this second issue of 2020, as well as we would also like to thank all authors who have submitted their manuscripts to ERIES Journal. We hope that all our readers will find this issue interesting, and we also hope that ERIES Journal will contribute with new insights, research methods and analyses to the field of efficiency and responsibility in education as it has contributed so far.

Sincerely

Martin Flégl
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CONTENT

INEFFICIENCY AMONG NON-ACADEMIC STAFFS IN NIGERIAN TERTIARY INSTITUTIONS: THE ROLE OF TRAINING AND DEVELOPMENT

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ABSTRACT

Inefficiency has been a major issue battling the service delivery of non-academic staff in most public universities in Nigeria and this has greatly affected the academic and research outlook of Nigerian universities. Interest in the study was to determine the extent to which induction, demonstration, on-the-job and formal training which are all elements of employee training and development enhance managerial efficiency by looking at employee productivity and quality of service delivery. The study adopts a convenience and stratified sampling technique to select 293 non-academic staffs in selected public universities in Nigeria and the analysis was carried out using the structural equation model (SEM). The results revealed that on-the-job training has a significant negative relationship with the quality of service delivery in Nigerian universities (t =-4.454), (p < 0.05) and β =-0.20) which could be because most Nigerian universities do not deliberately place new employees to learn directly from a current employee in order to improve their performance. Hence, the study demonstrates that the only way to resolve inefficiency among non-academic (administrative) staff in public tertiary institutions is to integrate effective training into employee career management and adopt employee performance evaluation process as contained in the private organizations.

KEYWORDS

Demonstration training, employee productivity, induction training, non-academic staffs, on-the-job training, service delivery

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Highlights

- *Inefficient employees in an organization can cause a total breakdown in the flow of activities and the achievement of timely organizational results.*
- *Formal training of employees significantly affect employee productivity.*
- *Induction training of employees significantly affect the quality of service delivery.*
- *Inefficiency among non-academic staff can be traced to nepotism, mismanagement, bureaucratic bottle-neck in Nigerian tertiary institutions.*

INTRODUCTION

The importance of employees in organizations goes a long way to determine the success of a business enterprise. This is because employees determine the flow and usage of organizational resources. In the word of Moulik and Mazumdar (2012) they are regarded as the active resources that an organization can possess as they are responsible for the usage of other resources of an organization in order to help organization achieve its goal and objectives. The business environment of an organization of today requires that organizations retain their knowledge capital (employees) such that they will be able to compete successfully in a dynamic and ever-changing business environment. The universities system requires the services of employees who are competent, motivated, well-trained and can successfully support the university academician to carry out research in an effective manner in order to achieve the goal and objective of the university both in the local and global environment (Obeidat, Masa'deh and Abdallah, 2014).

Training and development of employees is an essential determinant of employee effectiveness and efficiency in the organization. It goes a long way to help organization remain competitive and relevant in the dynamic and technological business world of today. Training is seen as a way through which organization gauges the inefficient part of employee work behaviour in the organization. The importance of training on employees in organizations of today is fast rising such that it is consistently required for employees to remain productive and motivated to perform optimally in the organization (Samuel and Chipunza, 2013). This means that continuous training and development of employees have gradually become the only means of survival in organizations due to the technological business era where most business operations have become digitalized. Similarly, the performance of a firm has consistently become a topic of discussion among management of an organization regardless of the short and long term goals on sight. This is because the performance of an organization is dependent on several factors in the organization among which are employee productivity, employee job satisfaction, employee attrition and employee retainer-ship all of which determine the success, profitability, and survival of an organization (Tettey, 2010). This shows that training and developing employees for better performance in organization determine whether organization will succeed or not.

Additionally, tertiary institutions are saddled with the responsibility of training and empowering people with the required skills necessary for successful integration into the workforce of an economy. Thus, training and developing university administrators in tertiary institutions go a long way to help the university system achieve the purpose and objectives through which it is set up (Abdullah, Ahsan and Alam, 2009). University administrators are expected to support the work of academicians in a university system to produce and train skilled workforce such that they will be able to critically think and solve community and society problems. Notably, effective training and development of university administrators go a long way to enhance the success of tertiary institutions to remain relevant and be well rated in both local and global environments. Obeidat et al., (2014) state that managerial components such as motivation, staffing, employee development, career management, and employee welfares need to be consistently emphasized by university management to ensure workforce development and readiness to cope with technological tools necessary for effective and efficient work delivery.

Furthermore, organization (university management) needs to recruit competent and qualified administrators that will support the educational services of the university system. This is because recruiting the right employees for the right jobs helps organization to remain focus in achieving their aims and objectives for which it was set up (Mackelprang, Jayaram and Xu, 2012). Effective training and development practices in the organization are important to enhance administrative and academic performance because it helps to improve university ratings, research capability, academic reputation and research contribution within the domestic and international community (Mathis and Jackson, 2011). The dynamic business environment as a result of technological innovation requires an effective strategy to be put in place to improve the educational services of both the academic and non-academic staff of an institution.

Hence, the non-academic staff of a university is the support system through which the success of the academician and students in a university relies upon. Most Nigerian universities are experiencing inefficiency and unproductivity among their staff and this is due to inappropriate possession of requisite skills in the institution's (Ng'ethe, Iravo and Namusonge, 2012). Inefficiency has grossly affected administrative staffs' performance which indirectly has reflected in the rating of the university especially when it comes to collaboration with the international community regarding issues affecting the university students and academic staff. The training and development of university administrators have greatly suffered recognition and this has affected the work of academicians in areas such as their research quality, academic services, teaching effectiveness and efficiency, university rating among others (Abeba, Mesele and Lemessa, 2015). Finally, this research was deemed important after reviewing thirty-five peer-review journals written on training and development and observed that elements of training such as (induction, on-the-job and demonstration training) have never been worked on especially with regards to non-academic staffs in the Nigerian public universities system. This, therefore, becomes the major contributions that this study intends to contribute to knowledge. The study also adds to the body of knowledge by looking at managerial efficiency from the angle of non-academic staff quality of service delivery and productivity which have remained idle from previous work of other authors on the subject matter especially in Nigerian public tertiary institutions contexts.

Human Resource Based Theory

The success of an organization is heavily dependent on the active resources of an organization and these active resources are the human capital that determines the usage of the passive resources for an organization (Armstrong, 2009). The human resources are the pool of employees that are under the influence of employer especially in a contractual relationship within an organization. Organizations need human beings to achieve set goals and objectives and to enhance organization competitive edge especially among competing firms within an industry. Thus, the human resource-based theory is hinged on the importance of human beings for the successful establishment and competitive performance of a business enterprise. The theory relies on two assumptions for a successful competitive advantage in an organization (McDowall and Saunders, 2010). First, the theory assumes that firms within an industry operate on different competitive edge depending on the capability of the resource that they control. Secondly, it assumes that since a firm's resources are not mobile or traded within an industry, thus, a company can retain a competitive edge acquired through firm resources for a long period of time (Olusanya, Awotungase and Ohadebere, 2012).

The emphasis of the theory, therefore, is that firms within an industry or strategic group compete with different resources

with regard to human beings and thus, will have a different competitive advantage. This means that if all firms in an industry have the same type of human resources, then all firms would operate on the same kind of competitive edge which may deter continuity and the success of an industry. The RBV theory is an essential measure of human resource efficiency for a firm's competitive advantage and performance within a firm's strategic group (Ezeani and Oladele, 2013). This shows that human efficiency within an organization is determinant of what becomes the fate of an organization within an industry. Human efficiency within an organization is expected to deliver different results for an organization in order to satisfy the needs of customers at an agreed cost. According to Barney (1991), the immobility and non-transferability of resources are not enough to ensure sustainable competitive advantage for firms within a strategic group. This means that for firms to achieve and experience a sustainable competitive advantage, its resources need to be rare and valued from the eyes of customers and improperly imitable and substitutable from the eyes of competitors (Obi-Anike and Ekwe, 2014). This theory is relevant to the proposed study because it emphasizes the importance of human resources efficiency at work and its effects on organization performance and sustainable competitive advantage. Thus, human resource efficiency in an organization cannot be overemphasized as it determines the success and or failure of an organization.

Inefficiency in Nigerian Universities

The non-academic department in a university system consists of works, bursary, librarian, medical personnel, exams and records, confidential secretaries, cleaners/messengers, administrative staff, account, security personnel among others. Many of these departments are greatly inefficient at their capacity to function effectively and support the university system to achieve its stated objectives and goals especially in state and federal universities in Nigeria (Iwuoha, 2018). For instance, exams and record department in Nigerian universities have a long history and mismanagement of student's results and preparing academic transcripts for students. This inefficiency has gone so deep to an extent where foreign universities or organizations will send a mail to exams and records department to confirm a student's academic status and will not get any response. Furthermore, a student will be processed for National Youth Service Corp (NYSC) and when the student comes back to request for his/her academic transcript, that when the exams and record department will found out that the students have a missing result.

Additionally, the bursary department will allocate a project or work to a contractor and bring up different stories and the issue of no funds after job completion. Furthermore, the department of works is seen as a department filled with incompetent staff who cannot successfully carry out a task especially with regard to employees who uses low-quality materials to execute a task (Samuel and Chipunza, 2009). This incompetence has become a general symptom in public institutions and organizations in Nigerian and this is because the recruitment process for this staffs is not based on the need for job performance in the organization but to satisfy top-ranking officers who have relatives that need employment opportunities (Moulik and Mazumdar, 2012). Similarly, most confidential secretaries in universities have no knowledge and capacity to handle computers or successfully preside over meetings such that they can take and read minutes of meetings. This issue of inefficiency among non-academic staff has become a menace and has damaged the university image both in the domestic and global level. It has even brought a set back to the academic activities in the universities (Samuel and Chipunza, 2013). The inefficiency among non-academic staff units such as exams and records, works and bursary among others are regarded to be lack of effective training and development and sometimes due to wrong placement and recruitment of staff.

Training and development as it is said that is an essential tool necessary for organization growth and survival especially in a dynamic and ever-changing business environment. Training and development are important for a university administrator to be effective and efficient at the work they do for the organization. This means that lack of training and development of university administrators would hinder the success and educational services of a university system and this would affect the rating and attraction of the university to the international community. Notably, inefficient training and development of employees among state and federal university administrators in Nigeria are attributed to lack of strategic career planning and growth, lack of adequate infrastructural facility and inadequate tools for employees to effectively perform at work (Diefendorff et al., 2018).

Non-Academic Staff Training and Development

There are several methods of training and development employed by most organizations to gauge employee job inefficiency. These methods are dependent on several factors such as organization's need, job performance needs, job duration, number of employees to be trained, the relative impact of the training among others (Oyeniyi, 2011). However, the most commonly used method of training in organizations of today is on-the-job-training, team-training, creativity, diversity, customer relationship management training among others. We also have off the job training such as employee induction, workshops, seminars, mentorship training among others. Some of these methods are usually not a common practice of most organizations as a way of gauging employee inefficiency but are recognized as a direct or indirect method used for employee training (Engetou, 2017). Additionally, training has been categorized into two different types; preservative and in-service-training. Preservative training is usually educational in nature as it is usually conducted by a formal organization where the participants are required to learn based on structured syllabus and contents for a particular period of time to acquire a formal degree or certificate. While in-service-training is consistently offered by organizations to all its employees for the purpose of improving employee's performance as it's related to organization activities (Emeti, 2014).

University management can enhance the non-academic staff functions by providing comprehensive job-specific training to all its administrative staff. This is only possible when an organization conducts job-specific assessment and performance

evaluation to determine the needs of each position as it relates to the type of employees required to occupy identified positions in the organization. This will help the university to determine the type of training needed and the right method appropriate for training non-academic staff for better performance on the job. Research has shown that organizations that train its employees to be problem-solvers, decision-makers, and enhance their interpersonal skills perform optimally on the job and improve organization competitive edge (Raja, Furqan and Muhammad, 2011). The current business environment is moving at an increasingly fast pace due to technological innovation and organizations that are not abreast of this reality are gradually going into extinction. Therefore, training non-academic staff on the use of some technology to get the job done is not a question required for debate but a must for an organization who want to excel both in the local and foreign environment.

Furthermore, there are many factors that determine the rating of an institution some of which are; research orientation and availability on the internets, quality of faculty members and international recognition and citation, teaching reputation, international student's attraction, and students' ratio. All of these rating criteria for university, directly and indirectly, involve the work and skills of non-academic staffs within an institution (Niazi, 2011). Thus, neglecting the training of non-academic staff training to be better equipped with the relevant technological equipment necessary for better performance on the job is at the peril of the university. It has been observed that non-academic staff training, especially in public universities in Nigeria and Africa as a whole, has been greatly neglected and ignored for several reasons. Meanwhile, effective and efficient performance is always expected from these staff as a result of the dynamic business requirement which imposes the use of technology as a means of getting work done in faster and easier ways. Hence, employees who are not trained especially on the use of these technologies are not expected to perform optimally on the job (Ndibe, 2014).

Employee Productivity and Quality of Service Delivery

According to Odhiambo, Njanja, and Zakayo (2014), the inefficiency of most employees in the organization can be traced directly to the recruitment and placement strategy adopted in the organization which sometimes is a result of an indirect linkage of employee capability and the job description and organization objectives. It is important to state that employee productivity has a direct impact on organization productivity as the former dictate the tone and direction with which the later will take. This is because of the overall productivity that an organization record within a year shows the extent of performance and productivity of individual employees within an organization (Papa et al., 2018). It is therefore important to recruit the right employees for a job position in the organization. Recruitment is the process of employing or engaging the best-qualified individuals which may be internal or external recruitment for an organization. It is the technique to discover the best workforce to meet the essential staffing plan and to use fruitful measures for attracting labor in adequate numbers in order to empower appropriate skills for a beneficial working power for the organizations (Dash and Mohapatra, 2016).

Furthermore, the quality of service delivered by employees in the organization can also be traced to the efficiency and effectiveness of the recruitment process with regard to job skills and placement strategy adopted. Employees that are placed on a job that does not match his/her skills will not perform up to the standard expected in the organization. However, the quality of service delivered to customers-clients of the organization indirectly determines the return purchase of such customers-clients which at the end impact positively or negatively on the overall performance of the organization. Thus, training and development can serve as the missing link to gauge under-productive employees and employees whose work standard and service delivery are below expectations in the organization (Papa et al., 2018).

Problem Statement

Administrative/personnel inefficiency is a menace to the growth and success of a business enterprise. Inefficient employees or departments in an organization can cause a total breakdown in the flow of activities and the achievement of timely organizational results. Inefficiency directly relates to inadequate manpower or resources used in an organization (Barzegar and Farjad, 2011). Thus, managerial inefficiency is a waste of manpower or resources by an individual or department in an organization. The inefficiency of employees or departments can be determined or measured from the results achieved from the set task and the standard given to such employees or departments from the inception of the task. This is why inefficiency in an organization is directly linked to the lack of adequate training and development of employees in an organization (Khan, 2015). Inefficiency is practically prevalent among the non-academic staff of most federal and state universities in Nigeria especially when it comes to effective and efficient administrative handling of academic activities with regard to issues concerning students, academic staff, financial planning, budgetary system/allocation, manpower coordination, and planning system. The lack of effective structure and the rigid bureaucratic system being practiced by these public universities coupled with managerial incompetence of non-academic staffs contributes to the dissatisfaction experienced by students and stakeholders in domestic and international communities (Lee, Lee and Wu, 2010).

Research Questions

1. How does induction training significantly impact the quality of nonacademic staff's service delivery in Nigerian Universities?
2. What specific impacts does on-the-job training has on nonacademic staffs' quality of service delivery in Nigerian Universities?
3. Does formal training significantly impact non-academic staff productivity in Nigerian Universities?
4. To what extent does demonstration training significantly impact employee productivity in Nigerian Universities?

Research Hypotheses

H_{01}: induction training has no significant impact on quality of non-academic staff's service delivery in Nigerian universities
H_{02}: on-the-job training has no significant impact on non-academic staff's quality of service delivery in Nigerian universities
H_{03}: formal training has no significant impact on non-academic staff productivity in Nigerian universities
H_{04}: demonstration training has no significant impact on employee productivity in Nigerian universities

MATERIALS AND METHODS

Data Collection Procedure

This study is purely quantitative because it adopts the use of a questionnaire as a method of gathering data to test hypotheses earlier stated in the study. The population of the study are selected non-academic staffs of federal and state universities in Nigeria. Thus, three federal universities and three state universities are selected for the study. Fifty non-academic staff who are permanent staff are selected from each of these universities making a total of three hundred non-academic staffs. The justification for selecting fifty respondents from each of the universities selected for study is because the study adopts convenience and stratified sampling technique and this enables the researcher to select respondents based on ease of access and based on some predefined selection criteria of non-academic staffs. The questionnaire was distributed to selected non-academic staff of Nigerian universities who meet the selection criteria based on the sampling technique and the distribution took a period of 3 weeks with the aid of three research assistants.

Instrumentation

The questionnaire used for the study were guided by established scale in literature. Hence, employee productivity scale was adapted from (Buuri, 2015; Leitão, Pereira, and Gonçalves, 2019), quality service delivery scale was adapted from (Parasuraman, Zeithaml and Berry, 1986) while training and development scale were adapted from (Demo et al., 2012). The scale was guided by a five point likert scale response type of strongly agree, agree, undecided, disagree and strongly disagree. The study adopts the use of statistical package for social sciences (SPSS), exploratory factor analysis (EFA), confirmatory factor analysis (CFA) and structural equation model (SEM) as a method of data analysis. SPSS was used to analyze respondents' demographic profiles such as (Sex, Gender, work experience among others), EFA was used to reduce redundant items and check the underlying questions and dimensions adapted from literature for each constructs of the study while CFA was used to determine the fitness of the model which is the determining criteria before using SEM to test the hypotheses stated in the study. SEM is appropriate to test the hypotheses stated in this study because the purpose of the study is to examine the significant connection existing between training and development of non-academic staff and their managerial efficiency in Nigerian tertiary institutions. A pilot study was conducted by selecting sixty respondents across the selected universities in order to confirm the reliability and validity of the instruments and the results revealed 0.84 which is above 0.70 as suggested by Nunnally (1978) as the threshold point for instruments reliability.

Context and Participants

The researcher administered three hundred questionnaires across the selected universities in Nigeria and only two hundred and ninety-three questionnaire were successfully returned and used for the analysis. The response shows that 39.5% are female while 60.4% are male. Furthermore, 13% of the respondents are below 25 years of age, 71.3% are between 25-30, and 15.7% are between 31-40. Respondents marital status shows that 76.1% are married while 23.9% are single which shows that majority of the respondents are married. Similarly, response based on educational qualification of respondent's shows that 48.5% are HND/BSC holder, 32.1% have MBA/MSc while only 19.4% have either PhD/DBA among the selected staffs. Additionally, 23.8% of the respondents have less than 5 years of work experience, 56.7% have between 6-10 years, 12.6% have between 11-15 years while 6.8% have above 16 years of work experience in the organization. Furthermore, 31.7% work in the department of accounts/bursary, 21.5% work in exams and record department, 12.2% work in library, 3.7% work in maintenance while 30.7% work in the department of works. Finally, 17.1% of respondents work as a confidential secretary, 29.7% work as a librarian, 32.1% work as an administrator while 20.5% work as an engineer.

DATA ANALYSIS

Exploratory Factor Analysis

Exploratory factor analysis was conducted using the principal axis factoring since the objectives were to examine the relationship between items or factors (Bandalos and Finney, 2010). Oblique rotation was performed to theoretically affirm the overlap expected to occur from the set subscales of the study. Oblique rotation is usually performed when the results from the EFA is expected to be used for conducting CFA as the EFA results are anticipated to allow a correlated latent factor (Matsunaga, 2010). Thirty-five items were subjected to principal axis factoring from the first loading and four items failed to load properly as the figure was not greater than 0.4, therefore, they were excluded from the factor arrangement. Hence, the remaining thirty-one items were subjected to eigenvalues greater than one and were considered for the second-factor loading using (principal-axis with direct oblimin-rotation). Therefore, five items were again excluded from the factor structure with eigenvalues greater than one making a total of twenty-six factor retained for CFA analysis.
The EFA results (see table 1) with regard to the Kaiser-Meyer-Olkin having (0.686), which is above 0.5 as recommended by Orçan and Yang (2016); Bartlett's test of sphericity is 0.000 and it is statistically significant at $p<0.05$, which means that there is a correlation between the tested variable, the degree of freedom is 190 and the chi-square value is 5,661.922. Furthermore, the EFA results further revealed the extraction communalities which is displayed below for the accepted twenty-six factors for CFA analysis and shows the extent of the correlation between the accepted items. The accepted factors all have a value greater than 0.4 as recommended by (Bandalos and Finney, 2010; Beavers et al., 2013) before conducting confirmatory factor analysis.

	X^2	*Df*	Bartlett's test of Sphericity	*p*-value	KMO
Measurement Value	5661.922	190	.000	0.05	.686
Recommended Value	✓	✓	✓	✓	>0.5

Table 1: Results of EFA Measures

Confirmatory Factor Analysis

The study conducts a confirmatory factor analysis (CFA) with twenty-six factors accepted from the results of EFA in order to determine the fitness of the model which is the first criteria before conducting a structural equation model (SEM). From the observed variables of induction training, two items were deleted (IT5, IT6), from the observed variable of on-the-job training one item was deleted (OJT5). Moreover, one item was deleted from the observed variable of demonstration training (DT1), while, two items were also deleted from the observed variable of employee productivity (EP1, EP4). The results of the composite reliability (CR) and the average variance extracted (AVE) for each of the variable tested is above 0.70 and 0.50 which is the baseline threshold as recommended by (Bagozzi and Yi, 2012) and this shows that the model is reliable. Furthermore, the results of the Cronbach alpha are greater than 0.70 as recommended by (Nunnally, 1978) as the threshold of acceptance.

Constructs		Mean	Standard Deviation	Item-Total Correlation	Cronbach Alpha	CR	AVE
Induction Training	IT1	3.46	1.124	0.641	.850	0.831	0.556
	IT2	3.77	1.249	0.767			
	IT3	3.68	1.387	0.698			
	IT4	3.79	1.310	0.664			
On-the-Job Training	OJT1	3.78	1.437	0.562	.821	0.798	0.505
	OJT2	4.04	1.267	0.783			
	OJT3	4.22	1.202	0.601			
	OJT4	3.92	1.197	0.650			
Demonstration Training	DT2	3.26	1.080	0.679	.857	0.748	0.503
	DT3	3.36	0.989	0.797			
	DT4	3.22	1.026	0.721			
Formal Training	FT1	3.08	1.060	0.828	.892	0.921	0.745
	FT2	3.08	1.052	0.819			
	FT3	3.14	1.095	0.811			
	FT4	3.17	1.095	0.812			
Employee Productivity	EP2	4.10	0.649	0.615	.747	0.716	0.582
	EP3	4.03	0.812	0.682			
Quality Service Delivery	QSD1	3.96	0.824	0.756	.859	0.863	0.678
	QSD2	3.99	0.754	0.718			
	QSD3	4.04	0.669	0.744			

*Note: **CR**: Composite Reliability, **AVE**: Average Variance Extracted, **MSV**: Maximum Shared Variance.*

Table 2: Reliability Measures Source: Field Survey, 2019

	X^2	*Df*	*p*-value	CFI	TLI	IFI	GFI	RMSEA
Measurement Model	2.848	190	< 0.001	.910	899	.900	.920	.07
Recommended Value	≤ 2 or 3			> .9	> .9	> .9	> .9	< .05 to. 08

Table 3: Results of CFA

Generally, the measurement model fit the data well as (X^2/df = 2.848, IFI, = .900, CFI = 910, TLI = 899, GFI = .920 and RMSEA =.07) which according to (Hair et al., 2017; Nusair and Hua, 2010; Sivo et al., 2006) are a good indication of measurement fitness, where, (X^2/df) represents the chi-square, (IFI) represents incremental fits index, (CFI) represents comparative fits index, (TLI) represents tucker lewis index and (RMSEA) represents roots mean square error of approximation. Therefore, the model fit assessment using CFA shows that it is reliable and surpassed the threshold for conducting a structural equation model in order to reject or not reject the stated hypotheses. Hence, the study tests the hypotheses using a structural equation model.

Results of the Hypotheses Testing (Path Modelling/SEM)

Four hypotheses are posited in this study and literature confirms that when $p < 0.05$ are a good indication that there is a significant relationship among measured and latent variables which then leads to either rejecting or not rejecting the hypothesis (Chinomona et al., 2010).

Hypothesized Model			R	R^2	β	Beta	t	significance
H_{01} Induction Training	→	Quality Service	.592	.241	0.15	0.567	3.234	***
H_{02} On the Job Training	→	Quality Service	.731		-0.20	-0.671	-4.454	***
H_{03} Formal Training	→	Employee productivity	.692	.312	-0.29	-0.679	-5.604	***
H_{04} Demonstration Training	→	Employee productivity	.675		0.23	0.789	6.760	***

Table 4: Hypothesized Model and Multiple Regression Coefficients

The table (see table 4) highlighted the hypothesized model in the order of their hypotheses as stated in the path analysis conducted in the study. Additionally, the table (table 4) also summarized the multiple regression coefficients from the output of structural equation model where *R* represents the correlation output, R^2 represents the squared multiple correlation output, β represent the unstandardized coefficients, and beta represent elements of the standardized coefficients, *t* represent the *t*-statistics and *** in the column significance means the level of significance, which is at 0.05.

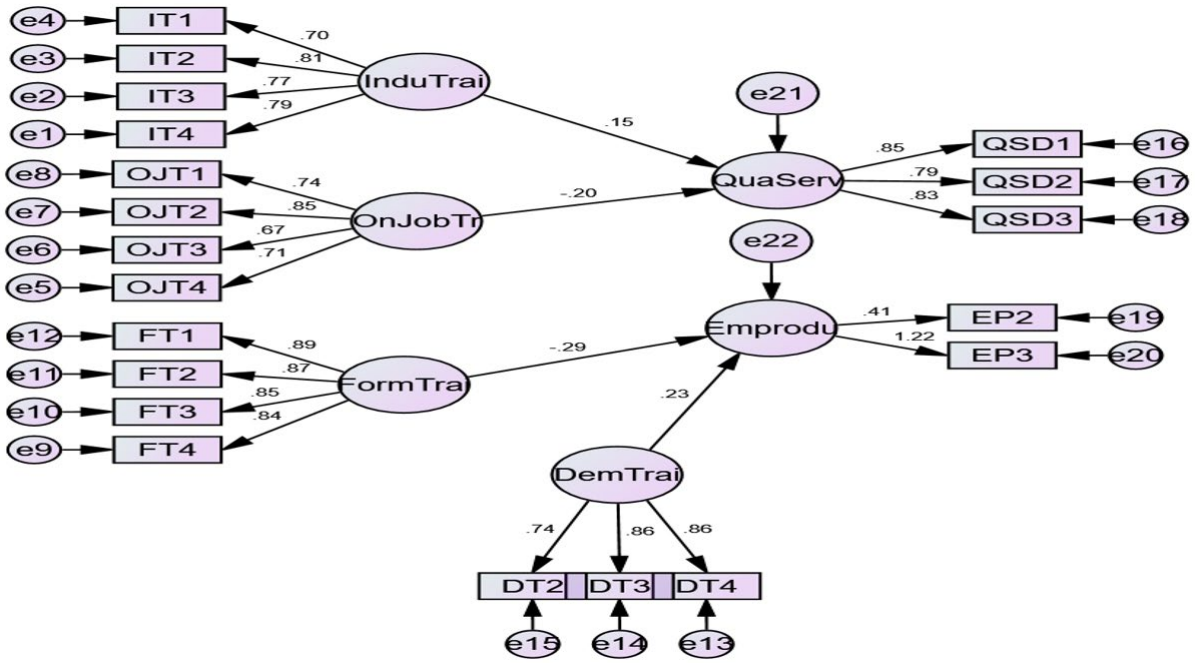

Figure 1: Showing Standardized Estimated Hypothetical Path Model

Path hypothesis one: this hypothesis tries to examine if induction training has any significant impact on the quality of service delivery of non-academic staffs in Nigerian universities. The result (see table 4) shows a positive relationship among tested variables, hence, the hypothesis is not rejected at $t = 3.234$ ($p < 0.05$) and $\beta = 0.15$. The finding indicates that employee benefits from the training giving to them at the points of entry into the organization. This finding is consistent with the study of Chen, Wang and Yang (2009), Khan (2015), Rizov and Croucher (2009) and Qureshi et al. (2010) and take a direct queue with the finding of Amin et al. (2014). Furthermore, the relationship between subscales and other latent variables for the purpose of this construct is consistent with the result of the study as there exist a positive relationship among subscales and other latent variables.

Path hypothesis two: this hypothesis tries to examine if on-the-job training has any significant impact on the quality of service delivery of non-academic staffs in Nigerian universities. The result (see table 4) shows a negative relationship among tested variables, hence, the hypothesis is not rejected at $t = -4.454$ ($p < 0.05$) and $\beta = -0.20$. The indirect and or negative impact of this hypothesis could be as a result of factors not tested in the study but which affect employee especially as it relates to their experience of on-the-job training in the organization. Although, the hypothesis tested for this study has a negative relationship but there exist a positive relationship between subscales and other latent variables for the purpose of this construct.

Path hypothesis three: this hypothesis tries to examine if formal training has any significant impact on employee productivity in Nigerian universities. The result (see table 4) shows a negative relationship among tested variables, hence, the hypothesis is not rejected at $t = -5.604$ ($p < 0.05$) and $\beta = -0.29$. This finding does not align with the work of Obi-Anike and Ekwe (2014) who found that the impact of formal training on employee productivity cannot be overemphasized as they consistently seek to help an organization achieve sustainable competitive advantage. Additionally, the relationship between subscales and other latent variables for the purpose of this

model show a positive relationship, which is not consistent with the finding of the hypothesis tested.

Path hypothesis four: this hypothesis tries to examine if demonstration training has any significant impact on employee productivity in Nigerian universities. The result (see table 4) shows a positive relationship among tested variables, hence, the hypothesis is not rejected at $t = 6.760$ ($p < 0.05$) and $\beta = 0.23$. This hypothesis shows a positive impact relationship which may be due to the effect of demonstration work impact on employee productivity. Finally, there exists a positive relationship between subscales and other latent variables for the purpose of this construct and it is consistent with the finding of the hypothesis.

DISCUSSION

The purpose of this study was to examine how training and development can improve non-academic staff work efficiency in selected public universities in Nigeria. Four path hypotheses were proposed for the study and four elements of training and development (induction, on-the-job, demonstration and formal training) served as the independent variable while the dependent variable which is managerial efficiency were considered looking at (quality of service delivery and employee productivity). From the four hypotheses proposed, hypothesis one and four shows a positive significant impact while hypothesis two and three shows a negative impact.

Finding from the first research question revealed that there is a significant impact between induction training and the quality of service delivery in Nigerian public universities. This is because the majority of the respondents attest to the fact that induction training given to them at the point of job entry significantly aids their performance on the job. This is further corroborated with the result of the hypothesis tested for the construct. They, however, could not affirm the willingness and adequate preparation given to their training induction by the management of the university as is mostly found in the practice of private organizations. Induction training is specifically important because it's the first practical know-how that new employees are exposed to at the point of entry into an organization. However, this finding does not support the work of Dialoke, Adighije, Nkechi (2017) an Engetou (2017) who found that most public organizations especially tertiary institutions do not officially carry out induction training for new employees (non-academic staffs). A current employee is usually appointed to show new employees the way to their department and the staff he or she is supposed to report to and this is done without any structured or formal training at the point of entry. Although, the finding supports the work of Abeba, Mesele and Lemessa (2015) and Amin et al. (2014). Induction training, however, represents the first training that employee receives from an organization and the purpose is to help new employees to settle in well on their new job.

The study also found from the second research question that on-the-job training has a significant negative relationship with the quality of service delivery in Nigerian universities. This could be because most Nigerian universities do not deliberately position new employees to learn directly from the current employee in order to improve their performance. Moreover, current employees, most times see new employees in their department as a threat to their job/position and thus, may refuse to share knowledge and information that would help new employees to improve performance (Moulik and Mazumdar, 2012). However, this finding is in alignment with the work of (Mungathia, 2019; Yusuf, Makera, and Kamaruddeen, 2019). Finding also revealed that Nigerian university management sees non-academic staff training as an exercise that is not worth investing on and thus, do not have any budget catering for the training of non-academic staffs. Hence, non-academic staff is left to personally seek means to improve their performance on the job and this is why inefficiency has plagued the activity of non-academic staff in Nigerian universities especially workers who naturally exhibit "I don't care attitude". Furthermore, the belief that government job is the most secure job and no senior staff can sack them for inefficient performance on the job contribute hazard to the inefficient behaviour experienced from most civil servants in Nigeria (Chen, Wang and Yang, 2009).

Similarly, the study also found from the third research question that a negative impact exists between formal training and employee productivity in the organization. This finding supports the work of scholars such as Bassey Owan and Agunwa (2019), Samuel and Chipunza (2013) and Tettey (2010) who found that training employees to perform optimally will significantly improve employee productivity/efficiency and directly enhance organizational growth and industry competitive advantage. However, this is usually not the case especially if the objective of formal training of employees is not well defined. This finding also aligned with common sense such that employee who is not performing very well in the organization need to be trained. Formal training is a deliberate act engaged upon by an organization to gauge an inefficient part of the employee to perform optimally for an organization (Barzegar and Farjad, 2011). Finding also revealed that most employees in Nigerian public universities have not been formally scheduled for formal training since they started work which is why most of them has been struggling to keep up with changing work conditions as a result of technological innovation.

Finally, finding from the fourth research question also revealed that demonstration training has a significant positive relationship with employee productivity in Nigerian universities. This could be because demonstration as a form of training requires some level of willingness by a senior member of an organization and even the top management to train young employees on the use of some tools in order to aid better performance and this is usually not the case in most public tertiary institutions in Nigeria (Bassey, Owan and Agunwa, 2019). Demonstration training is a practical way of teaching and imparting knowledge to employees and this is because it involves direct learning from an instructor in an organization. Respondents affirmed that the only demonstration training experienced is when they walk up to a senior member of their department to teach them on the use of some tools to aid efficiency at work especially when they are having difficulty using those tools/equipment to deliver on their job.

CONCLUSION

The issue of training and development of employees has become a vital tool in organizational growth and sustainable development especially with regard to public tertiary institutions in Nigeria. The reason is that the business environment is dynamically taking a new turn every day and technology is setting a new standard for job delivery and operational efficiency. Thus, an organization that wants to compete effectively and remain relevant in its industry must constantly seek to train and retrain its workforce in order to be abreast of technology advancement and its mode of getting work done in organizations. The inefficiency that has plagued the Nigerian public institutions has been found in this study to be as a lack of proper management training and development of non-academic staffs and extant literature has discussed extensively the importance of training and development on managerial efficiency, productivity and effectiveness and showed its relative impact on organizational sustainability and survival (Abeba, Mesele. and Lemessa, 2015; Dialoke Adighije and Nkechi, 2017; Olusanya, Awotungase and Ohadebere, 2012). Furthermore, the issue of inefficiency among non-academic staffs in Nigerian tertiary institutions as researched in this study can be traced to many factors such as corruption, nepotism, mismanagement, bureaucratic bottle-neck among others and this has dogged the inefficient services and productivity of these institutions (Yusuf, Makera, and Kamaruddeen, 2019). Therefore, Nigerian public institutions need to be intentional to create an enabling work environment for non-academic staffs that seek to improve employee's skills and capability through training and development to enhance employee career growth which directly and indirectly improves institution's domestic and international rating.

POLICY IMPLICATION

The reason why inefficiency has plagued the services of public organizations especially tertiary institutions in Nigeria is majorly due to factors such as nepotism, corruption and bottle-neck bureaucracy (Tettey, 2010). Employing based on family and individual needs and not based on the job-specific needs to kill efficiency and productivity for an organization. Public universities need to promote a scientific selection and recruitment of employees in order to eradicate people's person syndrome to employment, which has caused a lot of harm to the efficient operations of non-academic activities in public universities in Nigeria (Amin et al., 2014). The finding of the study shows that induction training contributes immensely to employee performance on the job and thus needs to be carefully encouraged for better performance to be consistently experienced from all employees (Abeba, Mesele and Lemessa, 2015). Moreover, employee promotion needs to be based on structured performance evaluation and feedback needs to be cheered in order to help non-performing employees examine his/her grey areas and work towards meeting set performance standards in the organizations.

It is believed that the activities of most Nigerian universities especially federal and state are controlled or ratified by the federal and or state government. Hence, the government needs to enforce a consistent training and development for both academic and non-academic staffs through a substantial budgetary allocation aimed towards improving the standards of civil servants to be at par with international universities at least once every year. This is important because the world is fast changing especially with the fourth industrial revolution setting new standards for job operations (Ng'ethe et al., 2012). Nigerian public universities need to keep abreast of this technological development and equip its administrative or non-academic workforce to deliver optimally and help project the institutions in such a way that it would improve the rating and standard of the university both locally and within the international community.

Furthermore, the finding of the study shows a negative relationship exists between on-the-job training and quality of service delivery. Many of the articles reviewed show a positive relationship existing between on-the-job training and employee performance which can be liking to quality of service delivery in the private organization (Abdullah, Ahsan and Alam, 2009). This, however, shows the importance of on-the-job training process that private organization has been adopting to gauge employee inefficiency and enhance standards performance of employees to be at par with what is required to compete with rival competitors. Thus, Nigerian universities need to be intentional with attaching underperforming employees to learn directly from a high performing employee at the university. They also need to eradicate the fear of senior employees losing their job or delayed promotion which make many senior performing employees hoard knowledge and information from underperforming employees with the hope that his/her monopolized knowledge/performance on the job will automatically enhance his promotion chances to bigger positions (Barzegar and Farjad, 2011).

It is important to also state that training and development of non-academic staffs need to be designed based on the need of the job and not based on opportunity to extort training budget out of the university account for personal benefits as is the most corrupt practices of some top non-academic officials in Nigerian universities (Khan, 2015). Employees' training and development need to be designed to enhance and improve employee job efficiency and capability, which directly position the research and academic activities of the institution for development among relevant stakeholders. For improved job efficiency and productivity, the HR department of these public universities needs to set the standard for each administrative job and promotion needs to be strictly based on the standard set. There need to be clear and concise key performance indicators (KPI) which serve as guide and evaluation of employee objective performance. These measures are quite important to achieve administrative efficiency in the Nigerian public institutions as they are measures guiding employee's performance in private organizations (McDowall and Saunders, 2010). The federal and state government need to desist from the practice of conducting promotional examination for civil servants as this hinder objective employee's performance evaluation and feedback from direct and indirect supervisors of employee's and the HR department of the organization. This is because anyone can sit for exams and pass especially when the material for such exams is readily available for practices.

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Full research paper

IDENTIFICATION OF CRUCIAL STEPS AND SKILLS IN HIGH-ACHIEVERS' SOLVING COMPLEX MATHEMATICAL PROBLEM WITHIN MATHEMATICAL CONTEST

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ABSTRACT

The aspects of inquiry based learning (IBL) are vigorously and frequently in the focus of recent studies. With the use of inquiry in mathematics in the daily school practice, some further questions are arising there: What kind of problems can be useful for an analysis of students' competencies in the field of IBL and how to assess the performed level of competencies? In this paper, the Mathematics B-day contest assignment is introduced as a mean to assess the students' performance in mathematical inquiry skills. Some new rubrics with didactical variables were designed as a tool for assessing students' competencies. The statistical implicative analysis was used to investigate 29 solutions of Mathematics B-day 2017: Arrow clocks. We identified the key subtasks solutions directly related to the level of the IBL competencies performed in the final mathematical investigation. The subtask which required actually high level of algebraic thinking influenced the level of the final mathematical investigation the most.

KEYWORDS

Assessment, competencies, inquiry based learning, mathematics education, open-ended problems

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Highlights

- *Problem aiming at algebraic generalization was identified as having the highest influence and impact on the process of the solution of the open-ended mathematical problem.*
- *Aspects of creativity were interrelated between the partial problems.*
- *Creativity manifested in the solution of partial problems influenced the IBL competencies manifested in solution of the open-ended mathematical problem.*

INTRODUCTION

The concept of Inquiry Based Learning (IBL) is based on the processes resting in posing, exploring and evaluating Yackel and Rasmussen (2002) define how to developing personally meaningful solutions, explaining students' approaches, ability to listen to each other and attempt to make sense of the thinking of other students as the characteristics of IBL. However, there is a necessity of teaching and learning with an understanding of what is essential for profound success in mathematics. Teaching and learning with an understanding requires a different approach of both involved parties, as the teachers, as the learners (Gonda and Tirpáková, 2018). Mathematical open-ended problems, which are close to the real situations, could represent a tool for the actual IBL implementation, and solutions there will require some specific multiple problem solving strategies. The term open-ended refers to an outcome of the work and to it whether more than one solution, design or answer is/are possible (Lock, 1990). On the other hand, contrary to the standard mathematical tasks, a solution of open-ended problems involves 'understanding the task, formulating an appropriate sequence of actions or strategy, applying the strategy to

produce a solution, and then reflecting on the solution to ensure that it produced an appropriate response' (Blaško, 2013: 126) and offer to students an opportunity to inquire in the field of mathematics. Thus and then the students have an opportunity to learn on the basis of their own developed abilities, their levels of mathematical thinking, and gradually, self-develop them further (Nohda, 2000).

In case of mathematical inquiry problems, not only the correctness of a referred result is assessed, but also an approach and the steps of such approach used to solve the given problem are in the focus of the assessment (Samková, 2018). Nohda (2000) describes several criteria that could lead to the assessment: (a) how many different solutions were found, (b) what different ideas were found and investigated, (c) to what extent is the referred solution of the problem original, and (d) whether the thinking mode is elegant.

The students' solution should be provided in the written form, not only reporting results but also a process of the solution with a scale of sufficient reasoning. The written report represents a complex summary and description of mathematical results and thinking processes in an individual or in a team work (Russek, 1998). It is necessary to include any original data, tables and graphs, performing an analysis of data and their interpretation based on a related mathematical model. The ability to create the mentioned report as a mathematical writing is defined in the report. The written report also displays creativity as a product in sense of Leikin and Pitta-Pantazi (2013). Sternberg (1998) defines creativity as an ability to produce an original, appropriate and useful piece of work.

Authors' department is an organizer of the Mathematics B-day contest for Slovakia. The origin of this contest comes from the Netherlands where their Mathematics B-day contest is based on the educational program of mathematics for the university level applied in technical studies, as well as studies in the field of science and mathematics. Students solve specific assignment created with the intent to motivate inquiry practice in mathematics. Participants are encouraged to "*use mathematical argumentation as much as possible*" (Arrow clocks, 2017, p. 2), which implies the results in the form of mathematical expression and calls for a sufficient level of generalisation. Such assignment comprises of about 15 to 20 pages of mathematical text divided into the basic and final assignments. Teams consist of three or four students who are working on a written final report by conjecturing and proving in mathematics, demonstrating their mathematical knowledge and competences (Utrecht University, 2018). 'The preparing for the competition, and trying to solve the problems during the competition itself, all participants increase their knowledge significantly, also the teacher gains an experience how to teach mathematical topics that are currently not in the curriculum' (Kenderov, 2006: 1589). Students are challenged to showing their own process skills in developing certain new strategies, making conjectures, trying to prove or reject these (Maaß and Reitz-Koncebovski, 2013). Through this process and awaited way, students are required to work as mathematicians, and just for it, this is one of the core characteristics of the IBL (Maaß and Artique, 2013).

Recent studies focus on the implementation of IBL into the current educational process (Engeln Euler and Maass, 2013; Bruder and Prescott, 2013). Therefore, Mathematics B-day contest provides students with a unique opportunity to participate in inquiring mathematical principles. The goal of this paper is to verify whether the complex assignment, like our Mathematical B-day aims to be, is a reasonable instrument to estimate an actual level of students' performance in the process of mathematical problem-solving. In comparison with the preliminary analysis (Medová, Bulková and Čeretková (2018), the current paper focus more on the process of assessing the students' solutions and presents the excerpts of their work. The following two research questions were formulated there:

What types of (implicative) relations do exist there between the levels achieved in the field of chosen attributes and manifested competencies?

Which subtasks of the basic assignment had a significant importance for the performance in the final assignment, particularly, in sense of manifested IBL competencies?

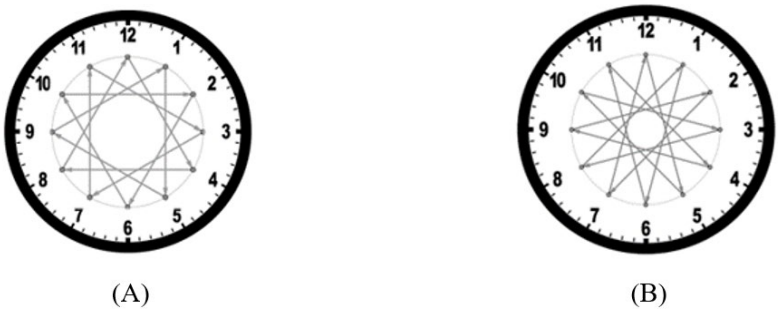
MATERIALS AND METHODS

Participants

The Mathematics B-day contest is aimed at the upper secondary students devoted and interested in mathematics. For the contest assessment as such only two best reports from each school are submitted, therefore a relatively high achievement in solving process and in creating the mathematical model can be anticipated. The actual ability to solve non-routine mathematical problems is definitely one among the basic components of the general problem-solving ability (Pantziara, Gagatsis and Elia, 2009). The non-routine problems always demand a high cognitive load (Schoenfeld, 1992), so the high-achievers' solutions need to be analysed. For this reason, the solvers, who participated in our Mathematical B-day, represent an appropriate sample for observing the level of different competencies related to the mathematical inquiry.

Assignment specification

In the assignment of Mathematics B-day 2017 the *Arrow clocks*, a number theory, was chosen as the main area for working with the divisibility of numbers and residual classes through modular arithmetic (Ďuriš and Lengyelfalusy, 2019). Whereas modular arithmetic is not usually a part of the Slovak mathematics curriculum the assignment can be considered as a series of novel problems for all the participating teams of students. As far as to other areas of mathematics, there was required a wider knowledge in the field of functions, projection in geometry, mapping the points based on the general rule $x \rightarrow ax + b$, etc. The whole assignment as such is designed in such a way that our students can move smoothly from some concrete results to some generalized conclusions, and then they can gain a new experience in the field of higher mathematics as a result. Thus, the basic assignment consisted of the eight main parts (with the subtasks marked with a letter, e.g. as 1a, etc.). The initial problem as a rule introduced the principle of the arrow clocks, as well as the way, how it can be represented by a simple prescription (Figure 1).



(A) (B)

Figure 1: Examples of Arrow clocks $x \rightarrow x + 9$ (A) and $x \rightarrow x + 5$ (B), $x \in \{1, 2,\ldots, 12\}$ (Arrow clocks, 2017)

Based on the introductory tasks, the students were exploring how the ornament is changing, observing new shapes based on the changing rule of arrow clocks. Their findings were aimed at several cases. Some ornaments of the arrow clocks were composed of regular triangles or quadrilaterals (Figure 1 A), and in some other cases, the shape represents one stroke which connects all dial faces (Figure 1 B).

The following problems were guiding an exploration of the properties of different types of clocks with different rules. The whole assignment is written with an intention to aim their exploration at the greatest common divisor of b (from the general rule $x \rightarrow ax + b$) and the number of points on the dial. For the sake of simplification as well as for unifying in the written report of the solution, the relation of congruency modulo n was explained to students by the simple visualisation (Figure 2).

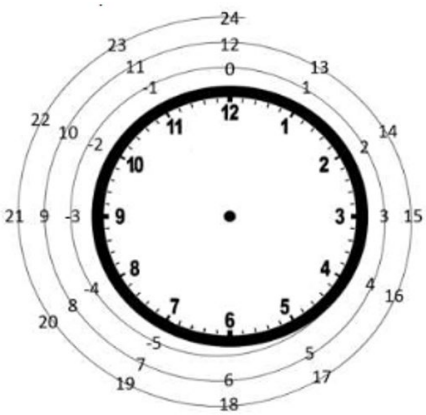


Figure 2: Model explaining the congruence modulo (source: Arrow clock, 2017)

Thus, the chosen knowledge coming from the number theory is followed by problems where the participating students can discover certain properties of various arrow clock patterns, and then, they are proving their validity in general. Indeed, the solved problems featured an increasing difficulty. For example, the standard clock face is divided into the 15, 17 or 45 parts, and later on, the variable n is used instead.

Gradually, by the generalization of previous explorations about modular arithmetic, by proving the conjectures and solutions and using the dynamic mathematics software GeoGebra for experiments, our students are encouraged to connect all their findings into a mathematical model. In the final assignment, students performed their own original research. They were challenged for the following subtasks: 'Describe what geometrical phenomenon you are seeing: think of the mutual placement of the lines or arrows, rotational or axial symmetry… Find patterns.… Explain the patterns.' (Arrow clocks, 2017: 14).

Rubrics

The assessment of the mathematical open-ended problem or mathematical inquiry problem is not uniform at all (Dorier, 2012). The correctness of results indicates some higher students' competencies, but also the steps of the solution process are in the focus of the assessing process. Several recent studies have been looking for an objective tool for assessing mathematical inquiry problems. Rubrics can be helpful to minimize subjective views in assessing the solutions of mathematical open-ended problems. To judge the quality of a broad range of subjects, the use of rubrics is a guide to the evaluation of the written work of students (Moskal, 2000).

Brookhart (2013: 5) defines rubrics as 'a coherent set of criteria that includes descriptions of levels of performance quality on the criteria'. To creating any rubric, it is necessary to define certain criteria specific for the assessed attribute and to specify the count of levels. The rubric is complete when the all levels of performance are described there. The purpose lies in the description of the level of the specific performance, while the assessor can select as many levels as it is necessary to describe in meaningful differences in performance quality.

The rubrics being used there to assessing the students' solutions had six levels based on the Bloom Taxonomy of Educational Objectives (Bloom et al., 1956). Each of these six levels defined in Revised Bloom Taxonomy of Educational Objectives can

be characterised by an active verb (Anderson and Krathwohl, 2001). In the case of mathematical inquiry, always students operate with their mathematical competencies, which are manifested in the solution as such. Therefore, any simple suitable assessing tool may be based on the analysis of students' mathematical competencies in the field of mathematical modelling skills as the highest level of mathematical thinking within the IBL structure. Mathematical modelling as such presents the highest level of mathematical thinking based on the IBL structure. Thus, while using and applying rubrics it is also possible to observe the development of the IBL aspects as such. Any coherent set of criteria is described by the IBL processes associated to the appropriate level vested in Bloom Taxonomy of Educational, see Table 1.

Level	Mathematical Competencies	Processes of Inquiry Based Learning	Active Verb
1	Usage of tools and information processing.	Sorting information. Observing systematically and visualising.	Remembering
2	Knowledge of concepts, facts, assertions and approaches. Application of symbolic, formal and technical operations.	Measuring and quantifying. Controlling variables.	Understanding
3	Description of mathematical objects and situations.	Discovering connections and relationships. Simplifying and structuring.	Applying
4	Defining the problem by asking a question. Mathematical thinking and reasoning.	Classifying and creating definitions. Hypothesizing and predicting.	Analysing
5	Mathematical arguments and proofs.	Experimenting. Inferring.	Evaluating
6	Mathematical modelling.	Mathematical modelling.	Creating

Table 1: Rubrics of mathematical competencies and IBL processes (source: Bulková, Čeretková, 2017a)

There is a possibility to create specific assessing tools relevant to other observed attributes. Mathematical writing can be used as an illustration of students' reasoning of a problem or concept (Kosko and Wilkins, 2010). For mathematical writing as such, there was created a set of rubrics for the three monitored attributes (see Table 2). The principle of integrity of any mathematical text is based on the fluency of text and the continuity of sections. Under the term mathematical reasoning the proper formulation of sentences and the usage of mathematical argumentation required in order to create a mathematical text is understood. As a rule, there should be expected the proper and logic use of the standard mathematical terminology as well as terminology established by students. The criteria of clarity and readability are always closely related to the previous criteria, i.e. mathematical reasoning and integrity of mathematical text. Therefore, any text has to be clear, without any errors interfering with meaning (Bulková, Čeretková, 2017b).

The criteria for assessing creativity according to Zak (2004) are defined consistently and thoroughly (see Table 3). The criterion of originality assesses whether there are developed any original ideas and conclusions through the way of connecting, developing and conditioning of existing information. The criterion covering correctness of conclusion describes the meaningfulness and coherence of the final conclusion depending on the choice of relevant pieces of information as well as on correctness of the defining concepts, creating proper equations, reasoning assumptions etc. Developed ideas are not necessarily applicable for particular problem, eventually for its generalisation. The criterion lies on the following three rules: (a) any idea as such is not wrong by itself, (b) it has to be tried, and (c) the immediate inferences do not have to be correct (Bulková, Čeretková, 2017c).

All the above defined rubrics can be helpful to minimize subjective views in assessing solutions of mathematical inquiry problems. To explore respective mutual relations between the defined attributes of assessing, the implicative analysis was applied.

Statistical analysis

The statistical analysis of the obtained data was performed within the software environment R (R Core Team, 2018), package RVAideMemoire. The success-rates in the subtasks of the assignment were compared by the Cochran Q test which is the generalisation of the McNemar test for two independent samples. The subtasks were considered as independent samples. Subsequently, the post-hoc analysis, comparing each pair of problems, was performed by the McNemar test. The level of studied variables in the final assignment according to the correct solution of chosen subtasks was compared by the Mann-Whitney's U test.

Following, the statistical implicative analysis (Gras et al, 1996) was performed using the software CHIC: cohesive hierarchical implicative classification ver. 3.3 (Couturier, 2008) and it was applied to explore respective mutual relations between the defined attributes of assessing and to evaluate relations between the subtasks in basic assignment and the students' performance in the final assignment (Table 4).

Then, two kinds of didactical variables were defined for all the subtasks; the correctness (Cor) of an answer for each particular subtask and the level of the observed property according to the above described rubrics (Table 5). Each of the "rubric" variables ending with a number according to level, e.g. MWrit_Intg_3 means that integrity of mathematical text reached the level 3. We take into account that the correctness of the given subtask is an observable fact and the variables based on these rubrics are theoretical constructs, but in agreement with Nesher, Hershkovitz, and Novotna (2003) we assume that an analysis of both types of variables can facilitate a deeper understanding of the all aspects needed for a correct solution of the complex problem.

Level	Integrity of Mathematical Text	Mathematical Reasoning	Clarity and Readability
1	The text does not meet the specific criteria for the coherent mathematical text. The used information is irrelevant.	The final report is composed from assumptions and reflections. It represents a sequence of unrelated materials. The mathematical terminology in text is not used.	The text is not clear, the language style and word choice are not appropriate. Readers not familiar with the given assignment can be unable to understand the text.
2	The text does not have a form of final report. The details are mostly relevant, but information may be straggly and inaccurate. Pictures and tables do not support the comprehensibility of final report.	The final report is not supported by any relevant facts. The basic mathematical terminology and argumentation is used.	The text is not entirely clear. The language style and word choice are simple. Readers not familiar with the assignment can be able to approximately determine the topic of solved problem.
3	The text is composed of more independent reports. Pictures and tables used in the report are not signed, described and arranged properly.	The final report contains the occasional mathematical argumentation, but there is a lack of mathematical reasoning within the solution.	The text is partly clear. The language style and word choice are simple. Readers not familiar with can be able to determine the topic of solved problem.
4	The text is composed of more dependent reports. Lacking details interfere with the coherence of text.	The final report contains the mathematical argumentation needed for processing the mathematical text. The reasoning used resembles the form of mathematical proof.	The text is mostly clear. The language style and word choice are mostly effective. Readers not familiar with the assignment are able to define the point of solved problem.
5	The text has the form of the coherent mathematical text. Lacking details partly interfere with the coherence of text. Tables and pictures used in report are disarranged.	The final report contains mathematical evidence supported by mathematical argumentation. Lacking connections between assignments were not explained.	The text is clear. Few errors do not interfere with meaning. Readers not familiar with the assignment are able to understand the solved problem.
6	The text has a form of the coherent mathematical text. Information is relevant and exact. Pictures and tables used in the report are arranged and signed properly.	The final report represents a coherent and organised mathematical text. The mathematical argumentation and mathematical proofs are fully used in the text.	The text is clear without any errors interfering with meaning. Readers not familiar with the assignment are able to understand the solved problem

Table 2: Set of rubrics to assess mathematical writing (source: Bulková, Čeretková, 2017b)

Level	Aspects of Originality	The Correctness of Conclusions	The Applicability of Conclusions and Solving Processes for Consecutive Investigations
1	All ideas are copied from the assignment and are created by rewording of that assignment.	The solution is not correct. Some information is not exact. Ideas are based on the false hypotheses.	The conclusions do not represent a tool for solving the problem, even for other purposes.
2	Ideas are chosen from the field of main topic. The conclusion is created by rewording the assignment or on the basic definitions of an expected result in order to fit it to.	The solution is not coherent. The used information is not cohesive and not clear.	The conclusions contain some elements for solving some particular partial problems, but not the problem as a whole. Ideas for solving the concrete problem or situation are useful.
3	Ideas are connected to the related mathematical field and to the basic assumptions.	The solution can be unclear in some parts, mostly because of the missing details or because of partially irrelevant information.	The conclusions represent some kind of tools for solving some particular problem, but the generalization of solution could be difficult.
4	Ideas are connected by the original description of basic concepts with the solver's assumption.	The solution is created by useful information from relevant sources, but some of them negatively interfere with the main idea.	The conclusions represent an important tool for solving the equivalent problem, for the problem with similar context or the close discipline. It is possible to make with modifications the universal conclusion.
5	Ideas are connected and combined mostly in the original ways. Ideas create a complex contribution for solving the problem.	The solution is created mostly by correct information. The inexact information or the missing details do not have an influence on the main idea.	The conclusions represent a universal tool for solving the problem with the same or similar context or the close discipline.
6	Ideas are combined in an original and surprising way for solving the problem or creating of something new. The conception of assignment is original.	The solution is created by correct information.	The conclusions represent a universal tool for solving problems from more disciplines.

Table 3: Set of rubrics to assess creativity (source: Bulková, Čeretková, 2017c)

	Assessed attribute	Levels (min - max)	Name of variable
Basic assignment (Subtasks 1a – 8b)	Mathematical competencies	1 – 6	MathCom
Final assignment (FA)	IBL competencies	1 – 6	FA_IBL

Table 4: Names of didactical variables defined for parts of the assignment

Assessed attribute	Criterion of assessed attribute	Levels (min – max)	Name of variable
Mathematical Writing	Integrity of mathematical text	1-6	MWrit_Intg
	Mathematical reasoning	1-6	MWrit_Reas
	Clarity and Readability	1-6	MWrit_Clar
Creativity	Originality	1-6	Cre_Orig
	Correctness of conclusions	1-6	Cre_CConcl
	Applicability of conclusions and solving process value for following studies	1-6	Cre_App

Table 5: Names of didactical variables defined for the criteria of assessed attributes

RESULTS

Out of total 29 submitted students' solutions, 21 started to solve the final assignment. The results obtained from the Cochran's Q test ($Q(24) = 232.396$; $p < 0.001$) imply that the three problems were not equally demanding (Table 6). The introductory tasks 1a and 1b seem to be the least demanding, thus, students should apply the rule for given value of a and number of hours n. The subtasks 7a and 7b had the lowest/least success rate. The task 7b is an investigation of the rule $x \rightarrow ax$ for the different values of a and n. Students were asked to produce an original work, to find the number of loops as a function of a and n, while in the task 7b students should explain the rule constructed in the subtask 7a.

Further, we focus on some pseudo-implications where a subtask and the final assignment were present simultaneously. Out of all the pseudo-implications with the cohesion higher than 0.9 only the variables of the subtasks 2a, 2b, 4d and 4e occurred together with any variable related to the final assignment. The subtask 2a was a reasoning task, while in the task 2b students were expected to compose a congruence equation for the given rule, describe the way how they came to it and solved it in the end. The task 4 was focused on the target points of arrows. The subtask 4d asked students to find a rule for finding a starting point of the target point for the given rule and n. This rule should have been adjusted and written as an equation for other n in the 4e subtask.

The most significant (cohesion 0.991) pseudo-implication of this kind was the pseudo-implication 4e_Cre_Concl2 → FA_MWrit_Clar2, it means that students who achieved the level 2 in the criterion for creativity "correctness of conclusions" in the subtask 4e were assessed at least by 2 in the criterion "clarity and readability" of mathematical writing. It means that the teams of students who were not able to formulate an appropriate reasoning for the subtask 4e did not write their solution of the final assignment very clearly.

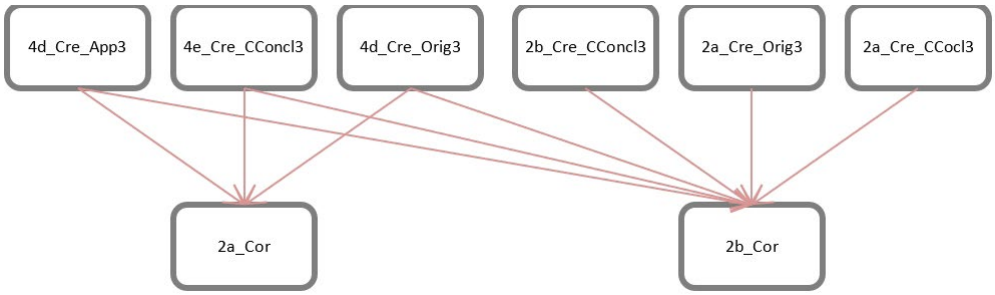
The pseudo-implication 4e_Cre_Orig2 → FA_Cre_App2 (cohesion 0.988) indicates that the relatively low level of originality in the subtask 4e implies the low level of applicability of conclusions and problem solving processes in the final assignment. It means that students who were not able to formulate particular general pseudo-implications algebraically had real problems with some possible generalisations of the pseudo-implications in the final assignment. This pseudo-implication further implies the pseudo-implication 4e_Cre_Concl2 → FA_MWrit_Clar2 with cohesion 0.982. This relation may indicate that the aspects of mathematical creativity can be related and therefore can influence different aspects of the solution of the final assignment.

Respective relations between creativity and other attributes of the solution can be seen in the R-rules for creativity in the subtasks 2a, 2b, 4d and 4e. Correct solutions of these four tasks were significantly conditional only upon the variables describing different creativity criteria. There were not any more pseudo-implications implying the variables 2a_Cor and 2b_Cor with cohesion higher than 80 (Figure 3).

Task	Success rate	
	Frequency of correct solution	Group
Task 1a	96.6%	a
Task 1b	93.1%	ab
Task 3b	89.7%	abc
Task 4b	86.2%	abcd
Task 3a	86.2%	abcd
Task 2b	86.2%	abcd
Task 2a	86.2%	abcd
Task 3c	82.8%	abcde
Task 1c	79.3%	abcdef
Task 4c	69.0%	abcdef
Task 4a	62.1%	abcdefg
Task 4d	55.2%	bcdefgh
Task 4f	51.7%	cdefgh
Task 1d	51.7%	cdefgh
Task 6a	48.3%	defghi
Task 8a	41.4%	efghi
Task 6b	41.4%	efghi
Task 4e	37.9%	fghi
Task 8b	31.0%	fghi
Task 6c	31.0%	fghi
Task 8c	24.1%	ghi
Task 6d	24.1%	ghi
Task 4g	20.7%	ghi
Task 7a	17.2%	hi
Task 7b	10.3%	i

Differences - frequencies followed by the same letter in column are not significantly different based on McNemar test ($p \leq 0.05$)

Table 6: Success rate in subtasks



Red full arrow: Cohesion of the R-rule is higher than 99

Figure 3: R-rules including correctness of the subtasks 2a and 2b

The previous pseudo-implication implies from FA_IBL3, i.e. FA_IBL3 → ((4e_Cre_Origt2 → FA_Cre_App2) → (4e _Cre_CConcl2 → FA_MWrit_Clar2). Based on this it can be concluded that the pseudo-implication described is valid for such teams of students who used at least the level 3 IBL processes, e.g. discovering some connections and relationships, simplifying and structuring. The students who used the level 3 IBL processes fulfil at least the level 2 of creativity criteria. Thus, discovering some connections and simplifying is necessary for solving the 4e subtask and the final assignment manifesting criteria for creativity at the level 2 or higher. This implication partially confirms that the B-day assignment can be used for assessing these processes. It can be presumed that for solving the subtask 4e at a higher level, definitely, some higher IBL processes were necessary and needed.

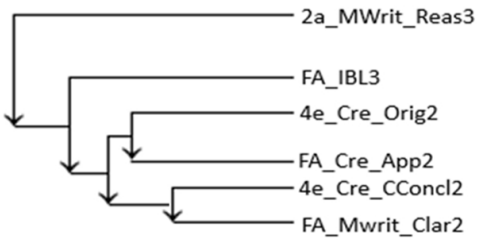


Figure 4: R-rules including correctness of the subtasks 2a and 2b

The consecutive pseudo-implication 2a_MWrit_Reas3 → (FA_IBL3 → ((4e_Cre_Orig2 → FA_Cre_App2) → (4e _Cre_CConcl2 → FA_MWrit_Clar2)) with cohesion 0.934 (Figure 4) includes also the subtask 2a. The main aim of this subtask was to demonstrate the understanding of the representation in a form of modular equation. A new type of equation provides participating students with the algebraic tool for solving the problem. Relatively high level of reasoning in this subtask may imply that the students accommodated the algebraic generalisation and this allowed them to solve the complex further on a more general level.

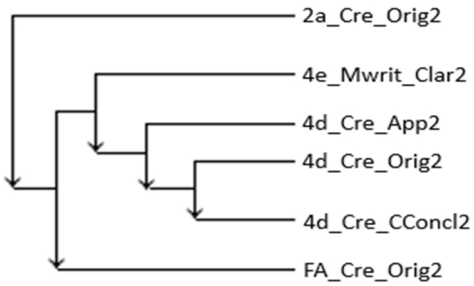
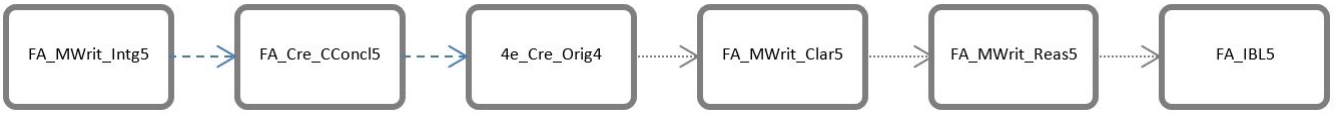


Figure 5: R-rules including correctness of the subtasks 2a and 2b

Certain interrelations and importance of the all aspects of the creativity are confirmed also by following the pseudo-implications (Figure 5). The pseudo-implication 4d_Cre_App2 → (4d_Cre_Orig2 → 4d_Cre_CConcl2) relates to the same level of the three investigated aspects of creativity manifested in one subtask, even though the manifested levels were relatively low. This relation is inferred by the low clarity of mathematical writing in the generalisation of the subtask 4e. Based on the pseudo-implication 4e_MWrit_Clar2 → (4d_Cre_App2 → (4d_Cre_Orig2 → 4d_Cre_CConcl2))) → FA_Cre_Orig2) we may conclude that the overall low level of creativity manifested in the subtask 4d and the low clarity of mathematical writing in the subtask 4e resulted in the low level of originality in the final assignment. The relations are further pseudo-implied by an insufficient reasoning in the subtask 2a, as 2a_Cre_Orig2 → ((4e_MWrit_Clar2 → (4d_Cre_App2 → (4d_Cre_Orig2 → 4d_Cre_CConcl2))) → FA_Cre_Orig2) (cohesion $c = 0.926$).



Blue dashed arrow: Cohesion of the R-rule is higher than 95; Grey dotted arrow: Cohesion of the R-rule is higher than 90

Figure 6: R-rules leading to the high level of manifested IBL competencies in the final assignment

The processes of inquiry based learning are also present in a series of R-rules (Figure 6) leading to the variable FA_IBL_5 which means that experimenting and inferring appear in the final assignment. It is conditioned by the high levels of integrity and clarity of mathematical writing, ability to formulate correct conclusions and provide reasoning in the final assignment and relatively high level of originality in the subtask 4e solution, i.e. with an ability to connect own ideas with the mathematical concepts provided in the assignment.

Students' solutions of the four subtasks were selected as an illustration of the coding (see Table 8). Solutions were distinguished by different ways of approaches.

Example of the subtasks 2a and 2b from the assignment and authentic students' solutions

'You looked into the rule of the form $x \rightarrow x + b$ for whole numbers b. In this case of an equilateral triangle we see: $x \rightarrow x + b \rightarrow x + 2b \rightarrow x + 3b$. For these values of you will have an equilateral triangle… except for 0.

2a Why do we also find $b = 0$, while we do not get a triangle?' Arrow clocks (2017: 6)

Solution A

The parameter b determines, how we assign the point to given x. In other words, if $b = 4$ then the arrow will lead to such a point which is on the circle further by 4 units. If $b = 0$, it means, the arrow will lead to a point plus 0 further. If the arrow leads to a point, which is by 0 further, it means, that the arrow leads to the same point, where we are now. In this case, there arises a loop.

So, we connect point 0 again with 0, point 1 with 1, point 2 with 2, 3 with 3,… and 12 with 12. And therefore, if every point is connected within itself, it is not possible to arise any triangle between such points.

Solution B

If we have a general variable n and we are trying to find the equilateral triangle for a random b, then $x \rightarrow x+b \rightarrow x+2b \rightarrow x+3b$. Then it applies:

$$x \bmod n = (x + 3b) \bmod n$$
$$x \bmod n = x \bmod n + 3b \bmod n$$
$$0 = 3b \bmod n$$

It results from the above given that $3b = nk + 0$, where k is the integer. After dividing by 3, we get $b = nk/3$. If $n = 12$, we get $b = 4k$ and it means, that b is the multiple of number 4. Except for $b = 0$ there is no triangle, because x appears in x, and all three vertexes of the triangle will be identical.

In case of the subtask 2a, students were encouraged to explain the specific situation for $x \rightarrow x + b$, where $b = 0$. Both solutions achieved the different level of mathematical competencies. Thus, in Solution A, students described the above-mentioned situation from more dependent reports and very clearly and the text is composed of more dependent reports, however, it is just a processed information from the assignment slightly complemented by symbolic and formal operations. Even the conclusion of the solution is correct, it is not formulated for the next applicability and it is not supported by mathematical argumentation. On the other hand, the comparison with Solution B shows an evident difference in the level of manifested mathematical competencies. Thus, students in Solution B described the solution also by a mathematical object and relation, in the concrete by modular arithmetic. Relatively high level of writing skills is represented by students' reasoning. The final report contains a mathematical argumentation needed for processing the mathematical text. Even the final idea of the solution is right, the correctness is interfered by the usage of the incorrect symbols for relation of congruence modulo n. The representation is expressed as the equation (=) except for the relation of the congruence (≡). In final, the conclusion with small corrections is applicable as a tool for solving the same or close problems.

'2b You can investigate in the same way for what b the rule $x \rightarrow x + b$ leads to the equilateral pentagons on a 15 hours' clock. Provide the equation; explain how you found it; and show you can solve it.' Arrow clocks (2017: 6)

Solution A

This relation expresses the all values b, by which the regular pentagon is created on the 15-hours dial. We put together the equation based on experimenting in GeoGebra. We found the values b, with which the regular pentagon is created and we found out there is a sequence between them. Based on this sequence (3, 12, 18,…), we created the above-mentioned relation. For every k, there are two values of b, which exist by adding or subtracting of number 3.

Solution B

$x + 5b \equiv x\,(mod\,12)$, because for arising the pentagon, we need to move x five times by number b, so that the point can return back to the initial x. Since $x < 15$, so $x \pmod{15} = x$, and we can write the equation in this way:

$$x + 5b\,(mod\,15) = x$$
$$5b\,(mod\,15) = 0$$
$$5b = 15k,\ \ k \in Z$$
$$b = 3k$$

If this equation holds, so for the given b we get the pentagon. Especially values for $b : b \in \{3;6;9;12\}$. For the value 3 we get the convex regular pentagon and for value 6 we get the regular five-point star, which vertexes lying on the circumcircle may be considered for vertexes of the regular convex pentagon, but in the same time, five new points arise by intersecting the line segments, which are connecting the points on the circumcircle. If the pentagon is considered as a unit, which points are lying on the circumcircle, so the solution is also number 6, if we look on the unit like on the decagon, so the number 6 is not any solution. Number 12 gives the same pattern as number 3.

For what reason are only these two numbers the solution? We can exclude all shifts by b, from which we can reach to the same point for the same x (the resultant patterns will be the same), so in the solution it is enough to state only $b_1 \in \{b_1; b_2; \ldots\}$, for its elements b_n and b_m holds:

$$x + b_n \equiv x + b_m \,(mod\, 15)$$
$$b_n \equiv b_m \,(mod\, 15)$$
$$b_n = b_m + 15k, \quad k \in Z$$

The subtask 2b followed after the subtask 2a, where the dial was extended from n=12 to n=15. Students in Solution A reached the conclusion based on the experimenting in GeoGebra. The conclusion of the solution is not formulated for the next applicability and it is not supported by a mathematical argumentation. The solution is composed only of the written description deducted from the assignment. Therefore, the conclusion does not represent a tool for solving the problem, even for other purposes. Solution B represents the coherent mathematical text supported by the mathematical argumentation. The conclusion represents the tool useful for solving the equivalent problem or for a problem with a similar context. It is necessary to point out, that students in Solution B distinguished the standard equation and relation of congruency.

Example of the subtasks 2a and 2b from the assignment and authentic students' solutions

'For the rule $x \rightarrow 4x$ and n = 15, 1 is a target point, because $4 \rightarrow 1$.

4d Use the fact that $4 \rightarrow 1$ to quickly find the starting point of the arrows with target points 2, 3, 4,…, 14.' Arrow clocks (2017: 8).

Solution A

The formula $x \rightarrow 4x$ for n = 15 has its target point 1, because $4 \rightarrow 1$ to quickly find the starting points for arrows with target points 2, 3, 4,…, 14. Whereas we know the target points, we can find out starting points for whatever arrow thanks to approach in part c). Then, for example, number 2:

$$4x = 2\,(mod\, 15)$$
$$4*8 = 32\,(mod\, 15) = 2\,(mod\, 15)$$

The starting point of the arrow, which leads into number 2 is 8. For other numbers, we have these below given starting points (see Table 7).

Target points	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Starting points	8	12	1	5	9	13	2	6	10	14	3	7	11	15

Table 7: Solution A for the subtask 4d

Solution B

The finding, that $4 \rightarrow 1$, we can use to quickly find starting points for the arrows with target points 2, 3, 4,…, 14. If $x \rightarrow 4x$ holds, then:

$$4x \equiv mod\,(15) = 15k + y$$
$$4x = 15k + y$$
$$4x - 15k = y$$
$$x = \frac{y + 15k}{4}$$

The number k has to be as small as it is possible to get to the point y after the first turn. We substitute for k gradually 0 as first, then 1, 2, until we find k so, that $y + 15k$ was divisible by 4. Then we will find also x.

The assignment was aimed at looking for patterns which were created by formulas of the functions. However, in the subtask 4d, students were asked to find the formula based on one representation. Both examples of students' solutions are described by mathematical objects and relations significant between them. In Solution A, students used the formula from the previous subtask. Though, the equation is not clearly stated in the description of the subtasks solution. The selected approach contains the required elements for solving some partial problems, but not for the entire problem as a whole. The solution is tabular. The argumentation and reasoning skills were at a higher level in Solution B. The conclusion in solution represents a universal tool for solving the problem with the same or similar context or a close discipline.

'4e Use the same method to indicate with an equation what the starting point is for every target point 1, 2,3,…,44 for $x \rightarrow 4x$ and $n = 45$.' Arrow clocks (2017: 8).

Solution A

By the same method, we would like to find out the starting point also for the all target points, if $x = 4x$ for n = 45. We already know, that $34 \rightarrow 1$, because 34*4 = 136 ≡ 1(mod 45). Thus, if a is the target point, then we can calculate its starting point as 34a (mod 45). This is because each following starting point (for the next target point) is by 34 distanced from the previous one.

Solution B

Now we have values $x \rightarrow 4x$ and n = 45. Let's divide the values of target points into 4 groups: $4p$, $4p + 1$, $4p + 2$, $4p + 3$, where p is the integer. With these values k = {0,3,2,1}, where we can express the formulas for x:

$y = 4p$: $\quad 4p = 4x - 0*45,\ x = p$

$y = 4p + 1$: $\quad 4p + 1 = 4x - 3*45,\ x = p + 31$

$y = 4p + 2$: $\quad 4p + 2 = 4x - 2*45,\ x = p + 23$

$y = 4p + 3$: $\quad 4p + 3 = 4x - 1*45,\ x = p + 12$

From this we are able to calculate every x if we know y, where $p = \left[\frac{y}{4}\right]$.

The subtask 4e was solved only by a few teams. The usage of the knowledge of concepts, facts, assertions and approaches were observable in Solution A. But the application of symbolic, formal and technical operations was missing in the written solution as well as a deeper argumentation. The solution so can be unclear in some parts. Solution B represents mathematical text which is supported by mathematical argumentation, even the details connecting it with the assignment were not explained. For this reason, even the solution contains some useful information, where some of it interferes with the correctness of the solution negatively.

	MathCom	MWrit_Intg	MWrit_Reas	MWrit_Clar	Cre_Orig	Cre_CConcl	Cre_App
2a	1	3	1	4	2	5	1
2b	3	4	4	4	3	4	5
4d	2	2	2	3	3	4	2
4e	5	4	5	4	4	4	5

Table 8: Coding based on the rubrics

The subtask 4e was really demanding for the all students. After excluding variables connected to the final assignment, one of the most significant pseudo-implications (cohesion 0.962) was 4e_Cor → (4e_MathCom4 → (4e_MWrit_Intg5 → (4e_MWrit_App5 ↔ 4e_MWrit_Clar4)))). The aspects as integrity, reasoning and clarity are difficult to be assessed separately, whereas, they are closely inter-related. The subtask 4e was solved correctly only by such teams who were able to reason at the high levels, their mathematical writing is clear and their resulting coherent text almost without any errors. The correct solution of this task is not related to the fact whether the students attempted to solve the final assignment or not (Mann-Whitney's U test, $p = 0.521$). However, on the other hand, the levels of almost all other studied variables (except aspects of originality, $p = 0.052$) of the final assignment differ significantly according to the Mann-Whitney's U test based on the correct solution of the task 4e (Figure 7). In contrary, however, the other three subtasks present in pseudo-implications with the high cohesion (2a, 2b, 4d) were not in a significant relation to any of the described variables.

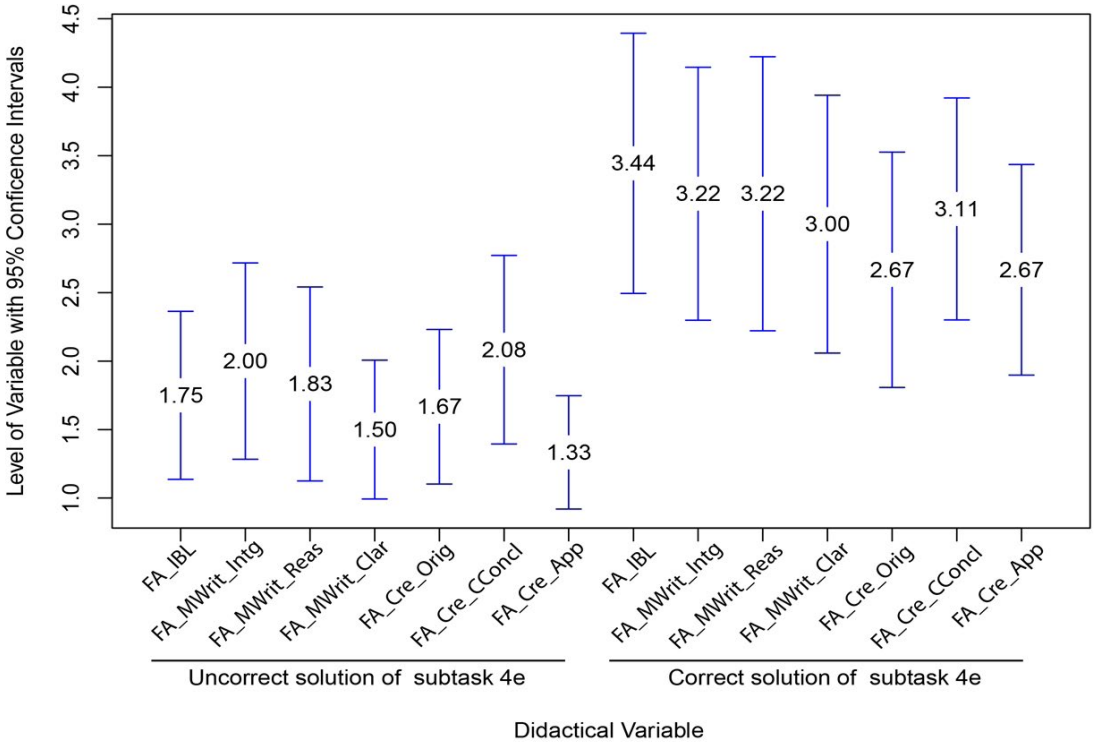


Figure 7: Plot means of variables describing the final assignment grouped by correctness of the solution of the 4e subtask

The statistical implicative analysis allowed us to define the 4 subtasks related to different aspects of students' solutions of the final assignments. Admittedly, success in solution of the subtasks 2a and 2b was mainly influenced by different attributes of mathematical creativity demonstrated in various subtasks (including 4d and 4e).

The correct solution of the subtask 4e, where some teams of students should compose the general equation, seemed to be crucial for the high level of the solution of the final assignment and hence for success in the competition. On the other hand, the solution of subtask 2b in the form of equation was necessary for general investigations in final assignment and did not influence the levels of different aspects of the final assignment. In contrast with the subtask 2b, the desired equation in subtask 4e was not necessary for the success in final assignment.

DISCUSSION

The main objective of this paper was to identify crucial processes, steps and skills necessary and required in solving complex mathematical problems. To observe high-level competencies used within the mathematical inquiry we worked with a problem stated for the mathematical contest and its solution by high-achieving upper-secondary students.

We are aware that our study has several limitations. Firstly, we focused only on some high-achieving students able to investigate mathematically and create innovative conclusions. However, exactly the focus on their high ability allowed us to observe a relationship between the basic and the final assignment.

It is necessary to point out that the final reports were composed by *selected teams* of students. In relation to this, Stacey (1992) found that teams' solution was not necessarily better than

individual one. Even though some groups have sufficient amount of ideas they fail to select the correct ones.

Based on the results implied from the statistical implicative analysis we identified the partial problems (subtasks) related to the final assignment which require an original mathematical investigation. The subtasks 2a, 2b, 4d and 4e were related to the final assignment. Two of these (2a and 2b) were conditional only upon the variables describing different creativity criteria. It is in accordance with Dow and Mayer (2004: 389) who found that 'solutions to mathematical insight problems lie in a novel approach to numbers'. These results confirm also the findings of Kamp (2016: 30) who claims that '…creativity in mathematics by the attitude to solving process is represented. Any solver focused on more possibilities to solve a given problem is open to reach a new view on the world, not only on mathematics'.

The subtask 4e requires students to develop an equation. Pantziara, Gagatsis and Elia (2009: 55) state that 'for novel tasks, like non-routine problems whose abstract structures are not known, the form of representation can determine the information that can be perceived, the processes that can be activated, and the structures that can be uncovered from the specific representation.' Generalising a pattern algebraically does rest in the capability of grasping commonality of particulars, extending it to the all subsequent terms and being able to provide a direct expression. According to Radford (2008: 95), students often fail at working out a formulation of the direct and meaningful rule, and only some students with their well-developed algebraic thinking are able to work with expressions and equations where signs and numbers 'acquire a non-contextual, relational mode of signification'.

CONCLUSIONS

This study was carried out with the aim to shed some light on the low-investigated area of solving novel complex problems. Within the basic assignment, we tried to identify some subtasks necessary for the successful solution of the final assignment by means of the statistical implicative analysis. The four subtasks were confirmed as having the greatest impact. The two subtasks (2a and 4d) were aimed at facilitating students to get a deeper insight to the problem situation and consecutive subtasks (2b and 4e) ask students to provide an outcome in the form of an equation.

The correct solution of the subtask 4e can be used as a predictor of the high-level performance in the final assignment despite an algebraic expression was not required there. Nevertheless, the necessary algebraic expression obtained in the subtask 2b did not show this effect. It seems that not the content but the processes involved in finding out for a solution are the actual key to the good performance in the field of mathematical investigation, particularly, in our Mathematics B-day contest.

Certainly, the well-developed, established and rooted social competencies of students (as mutual interaction and communication) are needed to be observed for the complex assessment of teamwork on mathematical open-ended problems requiring the inquiring in mathematics.

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APPENDIX

The subtasks 2a and 2b from assignment *Arrow clocks* (2017).

You looked into the rule of the form $x \to x + b$ for the whole numbers b. In the case of an equilateral triangle, we see: $x \to x + b \to x + 2b \to x + 3b\ldots$ For these values of b you will have an equilateral triangle... except for 0.

2a Why do we also find $b = 0$, while we do not get a triangle?

2b You can investigate in the same way for what b the rule $x \to x + b$ leads to the equilateral pentagons on a 15 hours' clock. Provide the equation; explain how you found it; and show you can solve it.

The subtasks 4d and 4e from assignment *Arrow clocks*.

4d Use the fact that $4 \to 1$ to quickly find the starting point of the arrows with target points 2, 3, 4,…, 14.

4e Use the same method to indicate with an equation what the starting point is for every target point 1, 2,3,…,44 for $x \to 4x$ and $n = 45$.

Full research paper

INDICES CONVERTING RESIGNATION AND DROP-OFFS OF BUSINESS STUDENTS TO RETENTION

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ABSTRACT

Each new generation brings a challenge to employers, university management and teachers with new attitudes affecting their continuous matriculation and degree completion. This article discusses how to retain both business and institutional career-oriented students using real-time communication based on their attitudes, emotions resulting from logically generated synonyms by automatic data evaluation by the information system. The objective of this article is to identify these students early in their academic studies and to assess their likelihood for continuous matriculation and ultimately increase retention rates. Using data from entry questionnaire during application at university, based on their attitudinal expectation, students were categorised into groups that affected their continuous matriculation. Data used in this study were gathered by compulsory entry questionnaire of 535 students in the academic year 2017-2018. Using statistical and dimensional analysis, four groups were identified among university applicants: Proactive, Reactive, Lazy and Institutional. Responses were tested according to Complementary Distribution Function (CDF) and normal distribution as Probabilistic Distribution Function (PDF). Antagonist attitudes were found for answers corresponding to PDF and CDF. Results indicate that business and institutionally oriented students should be separated and treated individually to increase retention.

KEYWORDS

Attitudes, behaviour, persistence, retention, student, university

HOW TO CITE

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Highlights

- *Four groups of students were identified: Proactive, Reactive, Lazy and Institutional.*
- *Evaluation of entry questionnaires based on synonyms can be used as predictors of student retention.*
- *The progress in data evaluation and quality management of university recruitment by systematic analyses is shown at case business university.*
- *The result of this study is that student behaviour measured by synonyms allow projection of their desired preferences that can be used to create retention strategies.*

INTRODUCTION

According to Thatcher et al (2016), Deveci (2015), and others, student's preferences at both private and public universities play a vital role to keep up the pace with the competition. Student's preferences show imaginary characteristics of the educational process in order to keep students satisfied. These preferences or perceived values are important to realize that the student's satisfaction with the organization of education, professional prospects, staffing, etc. affects the further formation of a college or university for potential new students (Kim et al, 2014; Aregbeyen, 2010). The opinion and feedback given by potential students have become one of the most important determinants of management and educational processes in higher education (Esparza et al, 2018). Collins et al (2017) in their research identified the benefits of undergraduate research participation for university students. The positive outcomes of participation are a robust positive predictor of five factors: gains in knowledge and skills, institutional support, overall satisfaction, grade point average, and student-faculty interaction.

There are several variables explaining the demand for higher education, which include e.g. individual, social, economic, and other factors (Duong, Wu and Hoang, 2017, Menon et al, 2017, Fürstenberg et al, 2017, Agbola and Cheng, 2017). For

students, economic factors are broadly discussed as they drive their future social status and position. According to Menon et al (2017) and Guerin et al (2017), there is a significant link between the perceived rates of return and the intention of a student to start and finish tertiary education.

According to Staiculescu and Dobrea (2017), universities should consider students by the categories of development of cognitive, social and affective attributes, where students significantly benefit from complex psycho-pedagogy support, counselling, internships, and practice. Kember et al (2017) identified that subject-independent learning activities were the most effective mechanism for students, followed by exposure to a rich campus environment. Thus, the curriculum should be viewed holistically, because employability of graduates is a major concern of universities, organisations and domestic policy (Staiculescu and Dobrea, 2017). Accordingly, support of education reform should ensure professionalization of graduates, the development of skills and knowledge as well as soft-skills and competences with focus on enhancing the potential of students upon graduation. In this context, universities have to offer to their students not only educational services but also counselling, support and orientation services that address and develop students' potential for educational and career path. Changes of behaviour between generations of baby boomers, generation Y, generation Z or any other name describing specific behaviour of different age groups are pushing especially private schools to adopt and change curricula to retain students.

The objective of this article is to identify these applicants based on their attitudes expressed in entry questionnaire, administered during application at university and to design and implement retention strategies specific to their unique attitude towards education. This early identification and classification of these indices will allow for specific and targeted retention strategies.

This paper is organized by sections, which includes introduction, theoretical background, methods, results, discussion, and conclusions. The methodology offers information on a research framework, sample size, measures and procedures. Results present intergroup behaviour and intragroup attitudes. Discussion links other results found in scientific papers and compare them or add to our results. The conclusion presents the study limitations and found attributes for managerial implications and theoretical contribution.

Theoretical Background

Retention is absorbing and continuing to keep students who are accepted for studies. The outcome of effective retention strategies is continuous matriculation, graduation and ultimately the attainment of educational and professional goals. Resignation, or drop-off, is describing oppose process when students are leaving studies… Verbal constructs describing resignation were defined by Zhang, Cao and Wang (2018). These authors identified that emotional intelligence (EI) with performance contribution satisfaction (PCS), efficiency satisfaction (ES), and interest satisfaction (IS) are main verbal constructs explaining the role of emotions in any process, behaviour and decision affecting resignation. These attributes are applied into the admission procedure and the behaviour of students during this process. Based on the results of Zhang, Cao and Wang (2018), EI and relationship satisfaction (RS) mediation role is only partial. Furthermore, this mediation role of passive-transactional leadership in the relationships of EI with RS and IS were identified but its mediating effects between PCS and ES were not found (Zhang, Cao and Wang, 2018). Emotions are mediating information transfer across all constructs except for the disconnected constructs of performance and efficiency satisfaction. Answers for PCS and ES were selected by respondents to show potential positive answers to balance the disconnected parts of verbalizing standard.

Further research tested or standardized disconnected synonyms of both PCS and ES. Yu et al (2016) iterate synonyms in vector space during the discriminative training of ambiguous cases. It is also possible to find that normativity replaces emotions and provoke observers to focus on the procedures of normative contestation, rather than on the substantive content of normative preferences (Sayer, 2011). Contents of normative contestation had a greater recovery of innovative liberal leaders during creation of norms with substantive content by purity/sanctity, social conformity and respect for authority principles (Graham, Haidt and Nosek, 2009) favored by recent position holders. Stevens and Zampini (2018) noted that normative beliefs are congruent with upholding the legitimacy and reproducing favored positions of social groups who have the power to define who is conforming and who holds authority.

Both standardization and testing of experiments are the responsibility of organizations and does not help individual to deal with emotions and chronic thinking. Therefore, framing can construct active and dynamic message delivering particular interpretation to its recipients (Benford and Snow, 2000). User generated content is an example of such individual interpretation while firm generated content generates larger positive relationships with regard to durables and non-durables, and with consideration, purchase intent, and satisfaction for services (Colicev, Kumar, and O'Connor, 2019) as one of the constructs. Dylman and Barry (2018) found other constructs using performance differences of cognitive training.

Preventive, experiential, and agreeable style of marking responses can explain alternative attitudes, which originate in ambition to claim up in or drop-off from hierarchical organizations. Preference analysis and segmentation decision (Liu et al, 2019), willingness to admit wrongness (Fetterman et al, 2019), willingness to accept or willingness to pay (Lloyd-Smith and Adamowicz, 2018, Luu, Ngo and Cadeaux 2018) explain retaining and repelling consequences of cognition arguing by dyadic perceptions of relationship value towards investments and performance. Boronczyk and Breuer (2019) were curious what changes the attitude more when rationalizing campaigns and maximizing benefits for its sponsors. Pre-exposure attitudes were similarly weak but significant. It was found that pre-exposure attitudes towards event are transferred to post exposure event reliably but without being associated with sponsor. Therefore, sponsors have no return on their support. Similarly, preventive sponsoring behaviour of teacher and parent have no impact on what happens in school. Reifkind

(2018) have associated low loyalty to focal sponsors with generalized complaint of employers that job applicants ignore scheduled interviews and new hires never shows up.

Then, marketing communication processes, which create, communicate, deliver, and exchange offerings to customers, clients, partners, and society are needed to establish positive relationships and expected behaviour (AMA, 2013). These relationships are observable using demand deriving markers of core concept as needs, wants and money available (Kotler, 1991). Recent authors begin to derive demand from wants (Asma, 2017), which brings specific reactions according to will (Libet, 1985). Individuals with long term will are pushed into risk eventually loss oppose to individuals with short term (Tversky and Kahneman, 1983). Some authors (Wang et al., 2013, Aghakhani and Main, 2019) try to avoid this confusion of constructs by indeterminacy, which presents all these observations as useless due to apparent necessity to tolerate incomplete behaviour of individuals and groups who are preparing themselves for challenges. Industrial clusters last until tolerance of incomplete behaviour allows them to maintain over time the competitive advantages arisen from external economies and joint actions developed in the cluster itself (Pezoa-Fuentes and Vidal-Suñé, 2017). Internal shaping of attitudes towards expectations, stress, eventually, burnout from repayment of investments, makes willingness to admit wrongness operable. Therefore, we must expect that technical component of empathic utterances predicts client language (Fischer and Moyers, 2014). Technical aspects can be related to standards to novel direction for translating relational skills. We have to expect that specific provider statements must respect proportion of reflections of change talk in association with client change language and treatment of outcomes (Barnett et al, 2014).

Magill et al (2016, 2018) support the technical component as an active ingredient of motivational interviewing (MI) predicting treatment outcomes from proportion of change talk to sustain talk. Villarosa-Hurlocker et al (2019) predict proportion of change talk from relational skills of client MI in-session language (empathy, acceptance, collaboration, and autonomy support) with expectation that provider will evoke client change talk and soften sustain talk. Therefore, empathy served by technical component predicts and influence attitudes and target market decisions.

This research of different impact of attitudes on behaviour is often processed statistically. Roggers (1983) has assigned names to representatives of intervals according to their attitude towards innovation as innovators (2.5%), adopters (13.5%), early majority (34%), late majority (34%) and laggards (16%). Many authors have extended this research framework of roles by general attitudes (Muehling, 1987) and its impact on parts of statistical distributions (Taleb, 2013, Bass, 1969) eventually its specific curves (Fenn, 2007, Kahneman, 2012, Schumpeter, 1926).

Phenomena of appearance in fat tails of normal distribution cause vulnerability. Therefore, Proactive, Reactive, Institutional and Lazy respondents in tails of normal distribution either offer complementary alternative or accumulate to preferred mainstream. The proactive respondents generate answers on questions in the first part, which list primary expected outcomes of studies (e.g. development of knowledge and skills). Reactive respondents, on the contrary, react on secondary outcomes of university education (e.g. ability development, gaining experience, broadening overview). Lazy respondents are responding to only one answer containing summary of all mentioned. Institutional respondents are only concerned about skills needed for their job position. The rest of the respondents belong to the group characterized by normal distribution. Complementary alternatives are usually more innovative and riskier than cumulated uniform behaviour. Probabilistic Distribution Function (PDF) characterize attitude of observer who is not able to distinguish who cumulate resources and who complement alternatives. In this study, we try to explain chasm between those who cumulate and those who complement by observation of internally used synonyms between respondents (Maloney, 2010). Cumulating and complementing respondents were analysed when the conjoint attributes form newness (high vs low) and functional newness (high vs low), resulting in a 2 × 2 design. A total of 170 college students (58.2% female), age 18 to 35, participated in the online survey for course credit. Respondents were shown a random set of products varying by form and functional information on the computer screen. After reviewing the product information, respondents were asked to make an adoption (Lee, Ho and Wu, 2018). A positive attitude does not necessarily results into adoption when consumers make their final choice oppose to moderating role of consumer need for uniqueness. Passion for uniqueness allows early fit of both cumulating and complementing respondents across the chasm. Based on the above mentioned, hypotheses for this study are as follows:

H0: Probability distribution function hide trial and error marking synonyms in answers between many normal respondents while improving robustness of conversion of resignation to retention.

H1: Conformance of cumulative proactive and complementary reactive respondents is converting resignation into retention oppose to institutional and lazy respondents.

Marking synonyms in answers according to normal distribution demonstrates a will of respondents to be transparent in verification of all offers including of unverifiable ones. This consistency of reactions is essential investment developing the trust of collaborators. Lazy and intelligent respondent finds time to focus by skipping the longest list of answers. Once benefits prove to be idle, the feedback between Lazy and non-lazy respondents show, which synonyms of offers benefit their development. Non-lazy respondents observe and follow Lazy respondents. Therefore:

H1a: Impatience of lazy/intelligent respondents has neither positive nor negative impact on resignation and retention.

Fear of lost post is demonstrated by neglecting of synonyms as precursor of drop-off according to prospect theory (Kahneman, 2012). Attitude and posts will retain if respect to institution is higher than own benefit by respondents who are waiting for call to action.

H1b: Institutionalists are making conversion of resignation to retention unmanageable.

Redundancy of synonyms is denied by standardized vocabulary,

which ignores all future aspirations. This is demonstrated by answer 'all above'.

METHODS

The data used in this study came from a primary quantitative survey by means of the questionnaire investigation collected by web survey (CAWI method). The survey took place in 2017 at a case university, during the academic year 2017-2018. The sample size comprised of 535 students. The data file comprised two groups: (1) students who dropped off during the first month (240 respondents) and (2) students who successfully continued their studies during the first year, 295 respondents. Answers of both retained and drop off groups, were analyzed to identify differences between the two groups and for the possibility to predict their behaviour and to guide actions to retain more students within the first year.

The evaluated areas in the questionnaire and in the evaluation of data are separated on preference in study, benefits of study, and expected curriculum (Table 1). Questions used in the survey are linked to theories (see the theoretical background) and similar research studies. Respondents' reactions to target statements and their attitudes to the given matter were restricted by offering a set of several statements. The statements design is based on literature review and in some cases modified according to the specifics of the university to fit its conditions. This study focuses on a more indepth discussion of the incoming students' preferences in higher education. The first stage of processing the questionnaire results focused on the preparation of a data matrix; data were sorted and coded according to the type of variables (qualitative, quantitative). During this phase, the data were cleaned, and the quality was checked in order to uncover any extremes (eccentric) or deviating observations, which could significantly influence the results of analyses. There were no missing values because all questions were mandatory. The last step of the data matrix processing involved the transformation of the variables, which fulfil conditions of a certain statistical method. The process of calculation and interpretation of results used methods similar to Hair (2011).

Applicants and enrolled students were marking offered wishful utterances in welcome post-purchase type entry questionnaire. Wishful utterances are projecting so bright outcomes of study that allow distinguishing students with over-expectations who usually hype and drop-off. It means that some of wishful utterances must not be selected as they are above the curve of normal distribution. Consistent attitudes of groups below curve of normal distribution (Roggers, 1983; Bass, 1969) were provoking intentions (Astington, 1993), stated choice (Fujii and Gärling, 2003) and perceived sufficiency of attributes. These attributes completed the listing of wishful utterances. The three entries into research framework fit with U-shape curve of Attribution Model of Online Advertising (Schulz and Dellnitz, 2017), which is used for reward distribution between participants of sales funnel, who are acquiring prospects and retaining clients. Pivotal utterances from inner and outer attitudes towards excellence were selected.

The qualitative data were processed using quantitative content analysis. The analysis used utilizes aspects of the text that are not apparent at first sight in a given amount of information. The procedure of the realized quantitative content analysis reflected the steps according to Disman (2002) with partial modifications according to the context of the research. First, there were defined statistically surveyed elements – synonyms, i.e. words, phrases or other parts of the text with similar meaning classified into categories and defined units to be analysed. Those units for analysis became particular terms, repeatedly mentioned by respondents. Terms were observed both as a whole (in certain context), but the attention was focused also on their particular components (words), phrases. For the creation of the qualification system, nominal qualification was created observing the frequency of the occurrences of the particular units in each category. The number of the occurrences of subcategories for each category was recorded.

The processing of the results was based on the analysis of the data focused on investigating important properties and the typical features of the statistical file. The statistical evaluation of the data undertaken firstly by a one-dimensional analysis based on the frequency distribution, the calculation of point and interval estimates and the testing of hypotheses about the frequency of the categories of individual variable values. Secondly, a two-dimensional analysis was used based on an investigation of the dependence of two selected variables. The goal of the comprehensive analysis of several variables was to uncover relations between data structures and to find an interpretation for these structures. Concretely, *F*-test and *t*-test were used.

Grouping of respondents was adapted for processing according to answers about future. Indices converting resignation to retention extracted from database provided answers in entrance survey. Four multiple-choice questions focused on retention:

- What do you expect from studies?
- What a graduate should know?
- What is important for you during studies?
- Where do you expect yourself to be after you finish studies?

Utterances oriented on output, process, input, and utility were offered to respondents (see Appendix). Offered utterances have reflected previous data collecting and processing experience of university staff according to incidence of marked utterances of retained clients. All respondents were allowed to mark more utterances, which seem to them either valid or synonymous. Therefore, less marked synonymous utterances could demonstrate ability of respondent to distinguish between them. Answers were coded 1 or 2 according to proximity with recent situation or 3 or 4 with proximity with competitiveness after graduation.

Option "other, describe, please" was marked by 31 of 535 student respondents. Written comments were received only from 14 of 31. Therefore, written notes were not further studied. Used figures and data were processed and generated in IBM SPSS.

RESULTS

Results presented below with the data from respondents (university applicants) were evaluated based on qualitative content analysis and then assigned to one of the four groups according graphical appearance on answers of four questions (Table 1).

Proactive				Reactive				Lazy				Institutional				Normal			
																+1			
																+1			
																+2			
																+3			
						+3				+2						+0			
	+0					+2				+3	+1					+2	+4	+2	
	+4					+3				+4	+1					+3	+3	+4	+1
	+1					+4	+1	+2		+2	+1					+2	+2	+3	+1
+2	+3					+2	+1	+4		+3	+1					+3	+1	+3	+1
+3	+2	+4	+4	+4	+4	+4	+1	+4	+4	+4	+4	+4	+4	+4	+1	+1	+4	+2	+1

Table 1: Graphical assignment of respondent to group – coded (Source: Own processing)

Respondents were assigned to group according to specifics of attitude they have recorded. Probability Distribution Function could not be used, except of normal group of respondents ($N = 353$). Therefore, answers of remaining four groups: proactive ($N = 22$), reactive ($N = 42$), lazy ($N = 91$), and institutional ($N = 49$) were processed according to normality biasing features. Sums of all answers for each of 4 code levels (CL) were tested on complementary accumulation or probabilistic effect. Small groups were merged to test CDF effect by PDF statistics oppose to normal group where PDF was present (Table 1). All four questions with all offered wishful utterances are in appendix. Selection from offered utterances are shown in columns with number of CL. CL4 means "all above", CL0 means the most wishful utterance like "manage a team". The most wishful utterance CL0 was not selected by any of five respondents in columns. Graphical example of number of answers of four questions shows differences between categories of respondents, which are described in heading row.

Resignation was found in tail of normal distribution containing Proactive respondents and Reactive respondents due to significant correlations with Normal respondents ($r = 0.863$; $p < 0.001$). On the other hand, there is no correlation between Normal and Institutional and Lazy respondents in oppose tail of normal distribution ($r = 0.052$; $p = 0.861$). Significant differences of pairs show that each group behaves consistently except of groups in tails of normal distribution. The only retaining group in tails of normal distribution are Lazy and Institutional respondents. Those agree with all suggestions. Therefore, promotion of intelligent Lazy students retains other students according to our results.

Exact answers of the four identified groups are included in the attached questionnaire.

The examination of data has revealed different incidence of used synonyms in predefined answers on questions gradually concretising image of future career of respondent. Decreasing incidence of synonyms was typical for proactive respondents. Increasing incidence of synonyms was typical for reactive respondents. No synonyms used were typical for institutional respondents, who have chosen mostly answered "all above". No synonyms on second question with the most answers have differentiated group of lazy intelligent respondents. Finally, number of marked synonyms of normal group of respondents had normal distribution. Respondents were assigned to one of the four groups according to graphical appearance of answers on each of four questions, see Table 2. Mean, standard deviation and standard error mean of answers of respondents in tails of normal distribution are low oppose to Normal respondents in the centre of normal distribution. It explains why cumulative and complementary distribution function were searched in tails of normal distribution oppose to probabilistic function in centre of normal distribution. All pairs had 14 code levels.

For our calculations, 'synonym', considered if two or more answers appear on motivating question about long and inconsiderable future. Number of synonyms marked by respondents of different groups vary by 50% (Table 3). Code levels of variables in first column are specified in appendix and methodology. Percentage is calculated from occurrence of marked utterance and total number of respondents of each group. Percentages above 100 show that there were more utterances with the same code. Proactive respondents have selected predominantly competitive and developmental utterances. Normal and Lazy respondents have marked benefits the most often. High percentage of the lowest level of development by all groups of participants shows either low self-confidence or difficulty to imagine own potential.

The processing of such inconsistent data with conflicting attitudes as PDF would lead to recommendation of care for each student of group during their course of study and education individually. On the other hand, used CDF processing allows the improvement of both time and robustness for retention of possibly resigning participants (Table 4). Correlation and its significance were processed for 14 code levels of each pair of groups of respondents. Based on results of Table 4, it is possible to evaluate hypotheses stated in the theoretical part. H1a: Conformance of proactive and reactive respondents is confirmed by strong ($r = 0.863$) and significant ($p < 0.001$) correlation oppose to H1b, where weak and insignificant correlation of association of lazy intelligent and institutional respondents ($r = 0.052$; $p = 0.861$). Therefore, there is almost no difference between fast start of proactive respondents if complemented by output focused on reactive respondents ($r = 0.676$; $p = 0.008$) and normal respondents who need to wait for full understanding to external impulses. Readiness to wait for approaching external impulses is retaining students from resignation.

		Mean	Std. Deviation	Std. Error Mean
Pair 1	Proactive _reactive	30.785	32.555	8.701
	Normal PDF	301.357	203.360	54.350
Pair 2	Institutional _lazy	47.642	49.147	13.135
	Normal PDF	301.357	203.360	54.350
Pair 3	CDF total	78.428	63.604	16.998
	Normal _PDF	301.357	203.360	54.350
Pair 4	Proactive _reactive	30.787	32.555	8.701
	Institutional _lazy	47.642	49.147	13.135
Pair 5	Proactive	9.857	8.291	2.215
	Reactive	20.929	26.371	7.048
Pair 6	Lazy _intelligent	39.357	37.497	10.021
	Institutional	8.285	16.335	4.365
Pair 7	Reactive	20.928	26.371	7.048
	Lazy _intelligent	39.357	37.497	10.021
Pair 8	Institutional	8.285	16.335	4.365
	Normal PDF	301.357	203.360	54.350
Pair 9	Institutional	8.285	16.335	4.365
	Proactive	9.857	8.291	2.215
Pair 10	Institutional	8.285	16.335	4.365
	Reactive	20.928	26.371	7.048
Pair 11	Lazy _intelligent	39.357	37.497	10.021
	Proactive	9.857	8.291	2.215
Pair 12	Lazy _intelligent	39.357	37.497	10.021
	Reactive	20.928	26.371	7.048

Table 2: Sorted data pairs for *t*-test (Source: Own processing)

BAHAVIOUR / VARIABLE	Proactive	Reactive	Lazy	Institutional	Normal
Number of respondents	22	42	91	49	353
Competitive 3	11	6	32	0	195
	50.0%	14.3%	35.2%	0.0%	55.2%
Competitive 2	18	10	52	7	281
	81.8%	23.8%	57.1%	14.3%	79.6%
Manipulated 4	11	11	0	0	341
	31.8%	26.2%	0.0%	0.0%	96.6%
Manipulated 3	8	7	1	2	278
	36.4%	16.7%	1.1%	4.1%	78.8%
Manipulated 2	7	9	0	3	290
	31.8%	21.4%	0.0%	6.1%	82.2%
Benefits 4	1	13	102	4	411
	4.5%	31.0%	112.1%	8.2%	116.4%
Benefits 3	2	15	62	0	263
	9.1%	35.7%	68.1%	0.0%	74.5%
Benefits 2	3	19	67	3	303
	13.6%	45.2%	73.6%	6.1%	85.8%
Development 4	0	13	19	0	70
	0.0%	31.0%	20.9%	0.0%	19.8%
Development 3	1	2	6	2	21
	4.5%	4.8%	6.6%	4.1%	5.9%
Development 1	20	41	89	44	337
	90.9%	97.6%	97.8%	89.8%	95.5%

Table 3: PDF oppose to CDF interactions (Source: Own processing)

		Correlation	*p*-value
Pair 1	Pro_reaction & Normal_PDF	.863	.000
Pair 2	Institution_lazy & Normal_PDF	.052	.861
Pair 3	CDF total & Normal_PDF	.482	.081
Pair 4	Pro_reaction & Institution_lazy	.178	.542
Pair 5	Proactive & Reactive	.676	.008
Pair 6	Lazy_intelligent & Institutional	.606	.022
Pair 7	Reactive & Lazy_intelligent	.042	.887
Pair 8	Institutional & Normální_PDF	.098	.739
Pair 9	Institutional & Proactive	.583	.029
Pair 10	Institutional & Reactive	.315	.273
Pair 11	Lazy_intelig & Proaktive	.094	.749
Pair 12	Lazy_intelig & Reactive	.042	.887

Table 4: Retention supporting correlations (Source: Own processing)

		Paired Differences					*t*	*p*-value (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			
					Lower	Upper		
Pair 1	Pro_reaction & Normal_PDF	-270.571	176.019	47.043	-372.201	-168.941	-5.8	.000
Pair 2	Institution_lazy & Normal_PDF	-253.714	206.739	55.253	-373.082	-134.347	-4.6	.001
Pair 3	CDF total & Normal_PDF	-222.929	181.489	48.505	-327.717	-118.140	-4.6	.001
Pair 4	Pro_reaction & Institution_lazy	-16.857	53.900	14.405	-47.978	14.264	-1.2	.263
Pair 5	Proactive & Reactive	-11.071	21.646	5.785	-23.569	1.426	-1.9	.078
Pair 6	Lazy_intelligent & Institutional	31.071	30.502	8.152	13.460	48.683	3.8	.002
Pair 7	Reactive & Lazy_intelligent	-18.429	44.933	12.009	-44.373	7.515	-1.5	.149
Pair 8	Institutional & Normal_PDF	-293.071	202.413	54.097	-409.941	-176.202	-5.4	.000
Pair 9	Institutional & Proactive	-1.571	13.328	3.562	-9.267	6.124	-.44	.666
Pair 10	Institutional & Reactive	-12.642	26.287	7.026	-27.820	2.535	-1.8	.095
Pair 11	Lazy_intelligent & Proactive	29.500	37.635	10.058	7.770	51.230	2.9	.012
Pair 12	Lazy_intelligent & Reactive	18.428	44.934	12.009	-7.515	44.372	1.5	.149

Table 5: Resignation supporting differences (Source: Own processing)

H1: Conversion of resignation to retention by association of proactive, reactive and normal respondents (Pair 1, Table 5) is the best of all other combinations.

Pair 3 CDF total & Normal_PDF ($r = 0.482$) do not reliably deny neither confirm H0 that probability distribution function by trial and error marking synonyms in answers ($p = 0.081$). Normal PDF respondents are weak to compensate errors from adversary trials between innovative pro_reactive and lazy_institutional respondents oppose to tails of normal distribution.

H1a: Impatience of lazy/intelligent respondents has neither positive nor negative impact on resignation and retention, hypothesis rejected. Intelligent laziness has shown to be ideal to accompany institutionalists in institutions (Pair 5, $r = 0.676$; $p = 0.008$) but not in innovative university. Therefore, impatience of lazy intelligent respondents isn't confirmed as he or she is intelligent enough to be lazy instead of waiting for call of institution.

H1b: Institutional respondents are making conversion of resignation to retention unmanageable. Also, this hypothesis was not rejected by readiness to wait for institutional approval off-setting approach to external impulses. Therefore, promotion of image of institution by waiting for call to action by institutionalists ($t = -5.417$; $p < 0.001$) is pushing other students to resign from image of manageability of future career (Table 5). All values of all pairs had *df* 13.

DISCUSSION

Results of the analysis show that synonyms in questionnaires are more useful for real time management than validated questions on emotions, attention, attitudes or logic which were used by Lutz, MacKenzie and Belch (1983), Muehling (1987), MacKenzie and Lutz (1989), and Mehta (2000). Still, this comparison is needed especially for synonyms in full text and discussions about future. Yu, et al (2016) iterates synonyms in vector space during discriminative training and measure the progress of the cognition of ambiguous cases. Ambiguous career of student and graduate from point of view of entry questionnaire is the example of such case, which should be monitored during training/education. Dylman and Barry (2018) have measured performance differences of cognitive training according to expectations of receiver. Similarly, respondents in this article could mark more synonyms according to expected agreement with question to demonstrate their interest or

promise to behave during studies at chosen university. Less often marked synonyms have demonstrated ability of respondent to distinguish between similar answers.

Hong et al (2016) stress flow experience, cognitive anxiety and learning progress to cognitive failure. They derived conclusion that negative correlation (r = -0.53; p = 0.001) between cognitive error during flow experience of habitual evaluation is blocking obtained information. Therefore, respondents' fear of rejection during entry questionnaire or test can be close to fear of error (r = 0.41; p = 0.001), which can be compensated by more marked synonyms. Nevertheless, correlation (r = 0.863) between Proactive, Reactive and Normal respondents found in this article is much higher and more significant (p = 0.000). This confirms implacable attitude between Institutional and Lazy inside of PDF towards CDF respondents, which Waring (2019) assigns to Alt-Rights.

Chang (2017) has confirmed that consumers behave accidentally if no pressure of situation is perceived in tails of CDF. This absenting pressure in tails of normal distribution observation could also decrease the number of resigned and increase the number of retained students on CDF students should decrease if separated from PDF students. Moreover, the origin of different behaviour under or without stress needs to be further analysed according to new observations of epigenetics, which have found that restriction prevents associative learning deficits but not changes in brain protein-adduct formation during ageing (Tolfsten et al., 2011). In addition, there is a need for further generalisation of implacable attitudes into personnel agenda.

CONCLUSIONS

The results of this study show that students behave differently. By assigning students to their respective groups early in their studies, it can provide a more descriptive understanding of how to deal with these students to affect retention outcomes. This study used graphical qualitative method whether respondent belongs to Proactive, Reactive, Lazy, Institutional or Normal group, as we saw each group behaved differently impacting matriculation. Their expectations should be addressed by university staff and serve as an advisory according to the preferred attitudes to their identified group. This identification and communication with the differentiated groups of students leads to increased retention since it is possible to address problematic students in the beginning.

The four hypotheses identified in this study have shown synergy of respondents behaving according to Probabilistic Distribution Function and proactive and reactive respondents behaving according to Complementary Distribution Function. They can process synonyms allowing projection of innovative career but not institutional one. Therefore, heterogeneous groups of students should not meet and communicate otherwise objective of retention will not be reached. When groups are separated then both resignation decrease, and retention occurs spontaneously. Proactive with reactive students invite normal students and lazy intellectual with institutional students will follow.

Description of the four groups of students for better understanding of the results with the most important characteristics of the groups are provided here with special attention to the tendency of resignation and special treatments needed for retention. Resignation was found in tail of normal distribution containing Proactive students and Reactive students due to significant correlations with Normal respondents than correlations between Normal students and Institutional and Lazy respondents in the oppose tail of normal distribution. Significant differences of pairs show that each group behaves consistently except of groups in tails of normal distribution. The only retaining group in tails of normal distribution are Lazy and Institutional students which agree with all suggestions. Therefore, promotion of Lazy intelligent students would retain them according to our results.

Results of two-step cluster analysis of synonyms are shedding more light into analysis of groups when describing laziness by clusters specified by factor „voluntary attendance" and „self-management" are the extreme of the most important output predictors and by factors of „abilities" and „methods" at oppose ends of bipolar scale. Therefore, promotion of laziness with these four clustering factors will be fully understood and followed.

The school management may identify to which group the student belongs if the questions with predefined answers will be filled by enrolled students. Promotion on impact of methods and abilities on saving time and good results of study will pre-empt his/her drop off.

The practical measures, which should be made by the schools should promote interviews with recipes of Lazy intelligent students on their experience with retaining main and peripheral benefits t.

The topic of this article is currently highly relevant for all higher education institutions from the perspective of student retention and, last but not least, for the reason of evaluating the global quality level of education management. The article also reflects the progress in insisting on the quality of the higher education system of recruitment influenced by systematic analyses, evaluation and the strategic management of particular college or university. The article provides evidence of how early stratification of students based on their preferences can yield a better understanding of these students and ultimately impacting completion rates. The limit of this article is its narrow focus on a case university in the Czech Republic, but the results as a case study with outcomes can help other colleges and universities to improve identification of progressive applicants and new students and also those, who need instant help to retain them. Automatic data evaluation system can help to proceed students' answers in entry questionnaire and select those, who need further consultations and advisory.

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APPENDIX

USED CODES OF ANSWERS TO RESEARCH FRAMEWORK

Questions and answers (It was possible to mark more options per question)	Code
QUESTION ON COMPETITIVE VARIABLES 1. What do you expect from studies?	
a) deep knowledge in studied domain	2
b) general overview	1
c) critical thinking	2
d) ability of independent analysis	3
e) ability to find new information	2
f) ability of information processing	3
g) all above	4
h) nothing from above	0
i) other, describe, please	2
QUESTION ON MANIPULATED VARIABLES 2. What an absolvent should know?	
a) work independently	2
b) find own position at labour market or in job	3
c) work in team	4
d) manage team	0
e) manage self (time management, stress management and similar domains)	2
f) plan assessment for own development and reaching own objectives	3
g) decision making according to qualification	1
h) presenting skills	1
i) communicate in two languages at least	1
j) use analytical methods of studied program	4
k) derive consequences	1
l) extrapolate, assess plans for future period	4
m) manage own business unit	3
n) all above	4
o) nothing from above	0
p) other, describe, please	2
QUESTION ON BENEFITS NEEDED 3. What is important during studies for you?	
a) accessibility of resource materials	4
b) flexibility of examinations	2
c) voluntarily attendance	2
d) available individual consultations	3
e) own study plan assessment	4
f) expert knowledge and abilities of teachers	2
g) practical implications	3
h) all above	4
i) nothing from above	0
j) other, describe, please	4
QUESTION ON EXPECTED DEVELOPMENT 4. Where do you see yourself after graduation?	
a) career progress	1
b) better post	1
c) better post protected by title	1
d) better remuneration	1
e) better non-financial appreciation	4
f) better life style	1
g) all above	1
h) nothing from above	4
i) other, describe, please	3

Source: university data, codes added.

Full research paper

PROBLEMS EXPERIENCED IN CLASSROOMS WITH STUDENTS FROM DIFFERENT CULTURES

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ABSTRACT

This study aimed at revealing the problems experienced by primary school teachers in classroom contexts which involve different cultures (Turkish, Iranian, Afghan, and Syrian). Phenomenology design was adopted in the study. The study group was defined through criterion sampling approach. Teachers serving at classrooms involving different cultures and teachers having different professional seniority were included in the study. Nine primary school teachers in total were interviewed, and the data were collected through open ended semi-structured interview questions. The data were analyzed through content analysis. After analysis of the data, the problems experienced by primary school teachers were gathered under three categories as; 1) problems experienced by themselves as teachers, 2) problems experienced in terms of students, and 3) problems experienced in terms of parents.

KEYWORDS

Culture, foreign student, intercultural education, primary school teacher

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Highlights

- *It is seen that teachers have various problems in education contexts where students from different cultures come together.*
- *Insufficient teaching experience, time and classroom management, discipline, and insufficient foreign language knowledge are among the most experienced problems by teachers and students.*
- *Teachers' attitudes towards foreign students and groupings among students affect learning - teaching processes negatively.*
- *Indifference of foreign students' parents affects the students' cognitive and affective skills.*
- *The fact that teachers do not have a specific curriculum to manage the learning-teaching process in a classroom environment where different cultures coexist poses a major problem for them.*

INTRODUCTION

Education contexts have recently been transformed into pluricultural and plurilingual environments due to international student exchange programs, migration, study programs, and, the participants of these education contexts bring their own cultural assumptions and experiences to the common practices conducted in these contexts (Holmes, 2006). Understanding and tolerating others in these contexts prevent misjudgments and prejudices which may otherwise cause communication problems among individuals (Reid, 2015). Students' having beliefs and attitudes which stem from their own experiences may lead them to understand situations differently from the intended purposes in contexts (Kramsch, 1993), and this highlights the importance of awareness of similarities and differences among different cultures. At this point, language may not ensure mutual intelligibility at desired level (Deardorff, 2011).

Culture as a notion has distinct definitions in different disciplines as it is viewed from particular perspectives due to the nature of study areas, and, it is regarded among the most intricate words (Moran and Lu, 2001; Nadeem, Mohammed and Dalib, 2017; Williams, 2014). Culture can be accepted as fixed common interpretations on feelings, values, norms shaped or shared by a group of individuals and can influence others' actions in group. Similarly, culture affects students' roles, teachers' roles, their self-analyses, and their responsibilities to take part in processes in a classroom (Israelsson, 2016; Kramsch, 1993; Lustig and Koester, 2003). Recently, understanding of culture has changed, and it has begun to refer to the practices devised

and generated via interactions among people in education contexts (Abdallah-Pretceille, 2006; Godley, 2012). Thus, new cultures and communication types are produced through social interactions within school contexts (Israelsson, 2016). Moreover, school success can be enhanced significantly, if education processes, cultural inclinations are compatible with experiences and learning styles. This success is obvious in school environments where culturally related content, teacher attitudes, expectations and actions come together (Gay, 2000). Intercultural awareness is not an orderly process to develop, and many factors can contribute to its enhancement (Krajewski, 2011). Individuals of the 21st century need to learn how to show empathy towards others as cultural diversity has become a forefront issue due to technology, globalization, mass migrations etc. (Chen and Starosta, 1996; Zimmerman, 1995), and they need to commence intercultural communicative competence to interact with the people from different cultural backgrounds (Arslan, 2018; Fantini and Tirmizi, 2006). Within this context, the individuals who have intercultural awareness benefit from successful and influential communication through their competences (Krajewski, 2011). Intercultural competence can be defined as the ability to participate in intercultural conversations actively and properly relying on intercultural resources such as knowledge, ability, and manners by ensuring mutual understanding as social agents (Byram, Gribkova and Starkey, 2002; Deardorff, 2006). Byram (1997) enlarges the term intercultural competence to intercultural communicative competence by taking discourse, linguistic, and sociolinguistic aspects into consideration.

Multicultural education aims to provide students with the necessary knowledge, skill, and cultural capital to maintain their lives in society (Banks, 2009). Furthermore, multicultural education is a complementary in preparing students for a democratic citizenship and developing academic success of students from different cultures in a pluralist society (Gay, 2016). Bennet (2003, cited in Ogletree and Larke, 2010: 3) defines multicultural education as "an approach to teaching and learning based on democratic values and beliefs and supporting cultural plurality at culturally different societies at national and international levels", and sequences four aspects of multicultural education as movement, curricula knowledge, processes, and commitment. An important purpose of multicultural education is to redesign schools for all students in order to adapt them into knowledge, attitudes and skills at ethnically and racially different societies and nations. Multicultural education intends to carry out equal education for students from different cultures, and to include them into national culture as critical and reflective individuals (Banks, 2009).

Teachers in Intercultural/Multicultural Education Contexts

Multilingualism, nowadays, is a globally accepted phenomenon as many students use different languages in education contexts and in their private lives; and this situation necessitates teachers to be equipped with essential skills to confront unexpected challenges that stem from cultural differences (Kasmer and Billings, 2017). Education contexts should provide learners and teachers suitable atmospheres in which they can easily take part in both intracultural and intercultural conversations. Teachers, as primary figures in classrooms, need to have necessary skills in order to communicate with learners from various cultures by keeping mutual intelligibility in an open and respectful manner without harming their cultural sensitivities. Additionally, teachers need to be prepared to cope with both students' available problems and increasing number of students from different cultures, and getting ready for becoming active and responsible citizens (Clewell and Villegas, 2001). They are also responsible from bringing their students up as active students who can see differences as positive factors. Thus, developments must be followed to overcome these problems, and teachers must be able to adapt different values, communication types by relating them successfully, if they are at these positions (Spinthourakis, 2006).

Most of the teachers are not convinced on the importance of multiculturalism in developing academic skills and forming a united society. Even teachers who believe in multicultural education are suspicious of its applicability. While some of the teachers state that they know nothing about multicultural education, the others state that getting prepared to accomplish standards takes their all time. Also, the teachers underline that overloaded curricula do not enable them to include multicultural education (Gay, 2016). An important finding of studies is that untrained teachers are not ready satisfactorily in designing learning contexts for students of different countries (Gay, 2002). Correspondingly, studies highlighted the profound influence of teachers' organizing sound education contexts in which they can feel free in making mistakes in complicated subjects for their learners, and these processes may not be conducted satisfactorily by teachers (Müller-Hartmann and Schocker, 2013). Organizing learning environments involving learners from different backgrounds may be troublesome for teachers while designing tasks. At this point, multicultural qualifications that teachers are expected to have includes, a) being aware of their own cultures and prejudices, b) being tend to learn perspectives of different cultures, and c) developing cultural sensitive teaching ways (Başbay and Bektaş, 2010).

Teachers' demographic profiles may remain nearly the same while the number of learners from different cultural contexts constantly increases; and, including intercultural competency in teacher training programs may be suggested to overcome this dilemma in such contexts (Chval and Chávez, 2012; Cushner, McClelland and Safford, 2009; Kasmer and Billings, 2017). Also, field experiences at the beginning of teacher training programs, designing international education programs, providing teacher candidates with studying abroad opportunities, and implementation of standardized documents such as the Common European Framework of Reference for Languages (CEFR) and the European Portfolio for Student Teachers of Languages (EPOSTL) in teacher training programs can be sequenced among effective approaches to enhance intercultural competence of both teachers and teacher candidates (Mewborn, 2000; Mirici, 2015; Ries, Cabrera and Carriedo, 2016; Smalley and Retallick, 2011; Şentürk and Mirici, 2019; Yüce, 2019).

Though there are many research studies available in the literature dealing with intercultural competence, intercultural communicative competence, and intercultural competence in learners, there are comparatively few research studies focusing on intercultural competence of teachers (Aguilar, 2007; Belz, 2002; Ghanem, 2017; Kohler, 2015; Liddicoat, 2002). Teachers have primary roles in intercultural education processes. Because, understanding and accepting cultural differences, conveying values, and developing intercultural problem-solving skills are among great problems experienced by students. Currently, teachers try to carry out teaching and learning processes under the same conditions for many students who come from different roots affected by cultural norms and values, and face numerous intercultural problems. Revealing and understanding these problems hold crucial importance for designing a culturally sensitive and successful education context for all students, and it can also contribute to education contexts positively by enhancing teachers' awareness and attitudes on intercultural education.

Therefore, the objective of this paper is to reveal the problems faced by teachers in classrooms where students with different cultural backgrounds study together. The research question of "What are the problems experienced by teachers in classroom contexts in which students from different cultural backgrounds study together?" was formulated in the study. Accordingly, the following sections were organized in the paper. Design, participants, data collection, data analysis, and trustworthiness of the study are explained in Materials and Methods section. Themes and categories obtained from the data as a result of interviews with teachers are presented in Results section. The findings of this study are compared to the findings in international and national literature in Discussion. Conclusion section briefly summarizes the main findings.

MATERIALS AND METHODS

Research Design

This study adopted phenomenology as research design. The purpose in research studies based on phenomenology was to depict experiences of participants regarding a phenomenon (Creswell, 2007). This design was chosen as the research aimed at revealing the problems that classroom teachers experience in classrooms where there are students coming from different cultural backgrounds.

Participants

"In phenomenology, data resources are individuals or groups who live this phenomenon and can reveal or reflect this phenomenon" (Yıldırım and Şimşek, 2013: 74). The participants of this study were classroom teachers who had been teaching at classrooms with students from different cultural backgrounds in one of the provinces of Central Anatolia Region in Turkey. Criterion sampling, one of purposeful sampling methods, was used in defining the participants (Yıldırım and Şimşek, 2013). Criterion was defined in terms of teachers' teaching experiences as 1-10 years, 11-20 years, and 21 and above years. Profiles of the participants are presented in Table 1 as follows:

Codes	FT1*	FT2	FT3	FT4	FT5	FT6	MT1**	MT2	MT3
Teaching Experience (Years)	8	15	20	19	23	10	24	17	18

**FT1: Female Teacher 1; **MT1: Male Teacher 1*

Table 1: Profiles of the participants (source: own calculation)

Nine classroom teachers in total were interviewed in the study. There were three male teachers, and six female teachers. The teaching experience of teachers ranged from 8 (the lowest) - to 24 years (the highest). The teachers participated in the study were serving in two different schools, and Turkish, Iranian, Afghan, Iraqi, and Syrian students were studying in their classrooms.

Data Collection

Interview is employed as a primary data collection instrument in phenomenology. The aim is to reveal experiences of participants regarding phenomenon through interaction, flexibility, and probe questions directed by researchers (Yıldırım and Şimşek, 2013: 74). Data of the study were gathered through semi-structured interview questions. A question and probe questions in parallel with this question were directed at the teachers. The question directed at the teachers was: Can you share your experiences of classrooms in which foreign and Turkish students studying together? The interviews were conducted at the schools where the teachers worked, and only the volunteer teachers were included in the study in these schools. The interviews were commenced after getting their consents. The shortest interview lasted 19 minutes and 48 seconds, the longest interview lasted 35 minutes and 40 seconds, and the average length of all interviews was approximately 25 minutes.

Data Analysis

Data analysis in phenomenology aims to reveal experiences and meanings (Yıldırım and Şimşek, 2013: 75). Content analysis was used in analyzing the data. The interviews were deciphered, and 34-word document pages were obtained from voice recordings of the interviews. Themes and categories were sought in the transcriptions. Responses to the same questions were written one under the other in order to reveal the themes and categories easily. The views undergoing the same theme were collected in coding process. Emergent coding was used during the processes (Elliott, 2018), and the themes and categories were explained within the light of phenomenon by the researchers. The themes were also visualized.

Trustworthiness of the Study

Multiple data sources were utilized in the study to enhance inner validity of the study (Merriam, 2013; Yıldırım and Şimşek, 2013). Math teaching classes of 2 classroom teachers were observed in order to ensure the data obtained from

the interviews. One of the observed teachers had 8 years of teaching experience, and the other observed teacher had 19 years of teaching experience. The observation reason of math classes was that math is a global lesson in which students from different cultures can easily express themselves. Observation form was developed by the researchers, and sent for evaluation to an associate prof. dr. (classroom education) and a professor (curriculum and instruction). The form was finalized based on the feedback from these two experts, and implemented in the process. Sample items from the observation form are as follows:

Items	Observed	Partially Observed	Satisfactory
Interaction between teachers and students can be achieved.			
The teacher encourages the participation of all students.			
The teacher respects all the students from different cultures.			
...			

Table 2: Sample items from the observation form (source: own design)

Purposeful sampling and thick description strategy were followed to provide outer validity of the study (Merriam, 2013; Yıldırım and Şimşek, 2013). The participant group was formed from the teachers who directly experience the phenomenon through purposeful sampling as they have students from different cultural backgrounds which makes easier to reveal experiences and meanings for the study. Teachers who have different teaching experience years were included in the study to get an insight into views related to experiences of classrooms with students from different cultural backgrounds. Points mentioned by the teachers were highlighted through the thick descriptions. Views mentioned by the teachers were expressed under the themes via thick descriptions. An external audit was consulted to enhance reliability of the data (Merriam, 2013; Yıldırım and Şimşek, 2013). The themes were re-coded by another expert. Also, findings of the study were compared to other research findings presented in the literature.

RESULTS

This part of the study aims to present the problems arising in classrooms in which students from different cultural backgrounds studying together. Within this scope, findings obtained from the analyses were collected under three themes, namely teacher, student, and parents.

Findings regarding classroom problems experienced by the teachers

Themes and subthemes regarding problems experienced by classroom teachers teaching in classrooms with students from different cultural backgrounds were presented in Figure 1. It is seen that the problems experienced by classroom teachers were categorized under five main sub-themes (Figure 1). These are; teaching inexperience, time management, classroom management, communication skill, and attitudes and prejudices.

According to Figure 1, inability of favoring individual differences, not knowing what to do in basic science classes, lack of communication between Turkish parents and foreign parents are among the most mentioned problems in the theme of teachers' lack of experience. Inability of sparing enough time for teaching, and inability of caring foreign students sufficiently are among the most mentioned problems in the theme of time-management. Chaos in classrooms, conflicts between Turkish students and foreign students, and foreign students' not participating in the learning processes are among the most mentioned problems in the theme of classroom management. Inability of understanding students due to language differences, inability of communicating with students, and inability of communicating with parents are among the most mentioned problems in the theme of communication skill. Inability to acknowledge foreign students and inability to show interests to foreign students are among the most mentioned problems in the theme of attitude and prejudice. Views of the classroom teachers regarding their problems in their classrooms are as follows:

FT1: [...] Processes are too slow. We could not follow our syllabi regularly. We cover topics in different times. [...]

MT3: [...] We had problems in terms of class instruments, pencils, and other resources. Also, the parents of these students could not spare enough time to their children due to their hard life conditions, and the students could not continue their education and they left school.

MT2: [...] Not knowing our language is the biggest problem both for us and for them, Syrian students. For example, the students coming from Afghanistan are a bit more motivated and they learn Turkish language faster than Syrian students. Our biggest problem with Syrian students is their forced and fast migration to our country, and not knowing our language. This automatically affects them. [...]

FT3: [...] Workload of teacher increases. Teacher needs extra effort. This situation tires out teacher. [...]

FT4: [...] Students do not continue to their education, instead they sell handkerchiefs on the streets. For example, I have 12 foreign students currently but most of them do not attend classes. As a result, they fall behind the topics. When they come again, you need to cover the same topics again. This bores the other students. Additionally, their protecting classroom materials are different. Local students are more conservative than other foreign students in protecting materials. [...]

FT6: [...] They always speak in their native languages in my classes though I warned them many times. You cannot respond them as you do not know their language. Language is a serious problem. [...]

MT1: [...] I have not a serious problem with foreign students actually, I say once a new word and they easily understand it. The problem occurs with the ones who come without any knowledge of the language, and this necessitates time to overcome problems. [...]

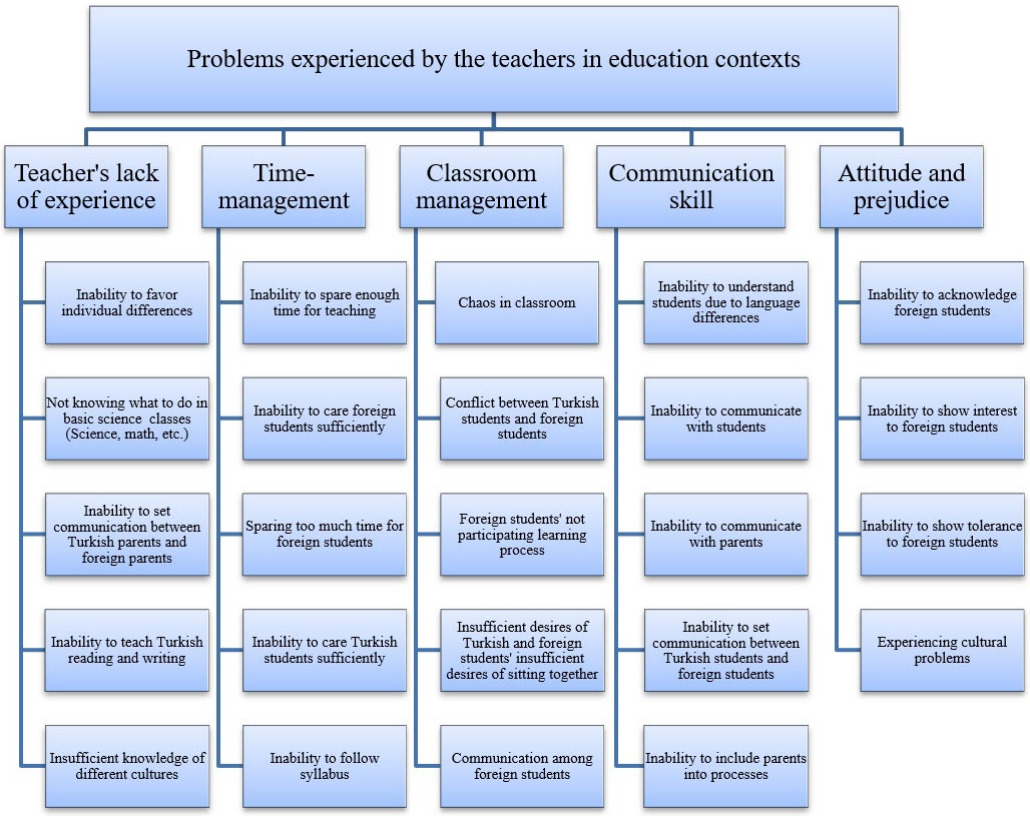

Figure 1: Problems experienced by the teachers in classrooms with primary school students from different cultural backgrounds (source: own calculation)

Findings regarding problems experienced by the teachers in terms of students

Themes and subthemes regarding problems experienced by classroom teachers teaching in classrooms with students from different cultural backgrounds are presented in Figure 2.

Problems in terms of primary school students coming from different cultural backgrounds are described under 6 subcategories (Figure 2). These are problems regarding learning, discipline problems, communication skill, insufficient knowledge, basic needs, and attitudes and prejudices. Inability to understand what is read, inability to understand what is said, and not fulfilling responsibilities are among the most occurring problems under the subtheme of problems regarding learning. Orientation problems of foreign students, conflicts or grouping problems between Turkish students and foreign students, and attendance problems are among the problems of the subtheme of discipline problems. Language problems among the students, and language problems between teacher and students are among the most occurring problems under the subtheme of communication skill. Not knowing Turkish language, being insufficient in basic science classes, and not being familiar with the Turkish culture are among the problems under the subtheme of lack of knowledge. Hygiene, and malnutrition problems are among the problems under the subtheme of basic needs. Lastly, Turkish students' underestimating foreign students, and students' isolating each other are among the problems under the subtheme of attitude and prejudice. Teachers' views on problems in terms of their students are as follows:

MT3: […] I asked their phone numbers, and used to call the parents whose child was absent every morning. I used to inform the parents about their children. They either used to respond my callings several hours later or not to respond back. […]

FT1: […] We have a course duration. To what extent can we deal with these students, ant there are many students with different levels in classrooms. We are unable to spare enough time for these children. You need to teach letters from the very beginning and need to deal with them constantly. You cannot teach letters just in 2 minutes. […]

FT3: […] Language is a crucial problem for them. […] If they knew language, there would not be any communication problems […]

FT4: […] There are constantly conflicts among students. They can isolate newcomers at their first arrival. […]

MT2: […] Acknowledging each other takes time for students. Foreign students did not feel themselves belong in here. Local students did not accept them as foreign students performed behaviors different to local culture. Differences in languages and cultures caused prejudges among students. […]

FT2: […] Cultural problems occurred at first years. […]

MT1: […] One of the students damaged a desk in the classroom, and I warned him. But, he did not clearly understand me because of insufficient language. […] When I was monitoring halls, I saw two students, from different countries, fighting with each other. […]

MT2: […] Math is a global lesson, but our classes a bit slow due to language problems. Besides, the curriculum is not intensive. So, our classes are neither bad nor good. […]

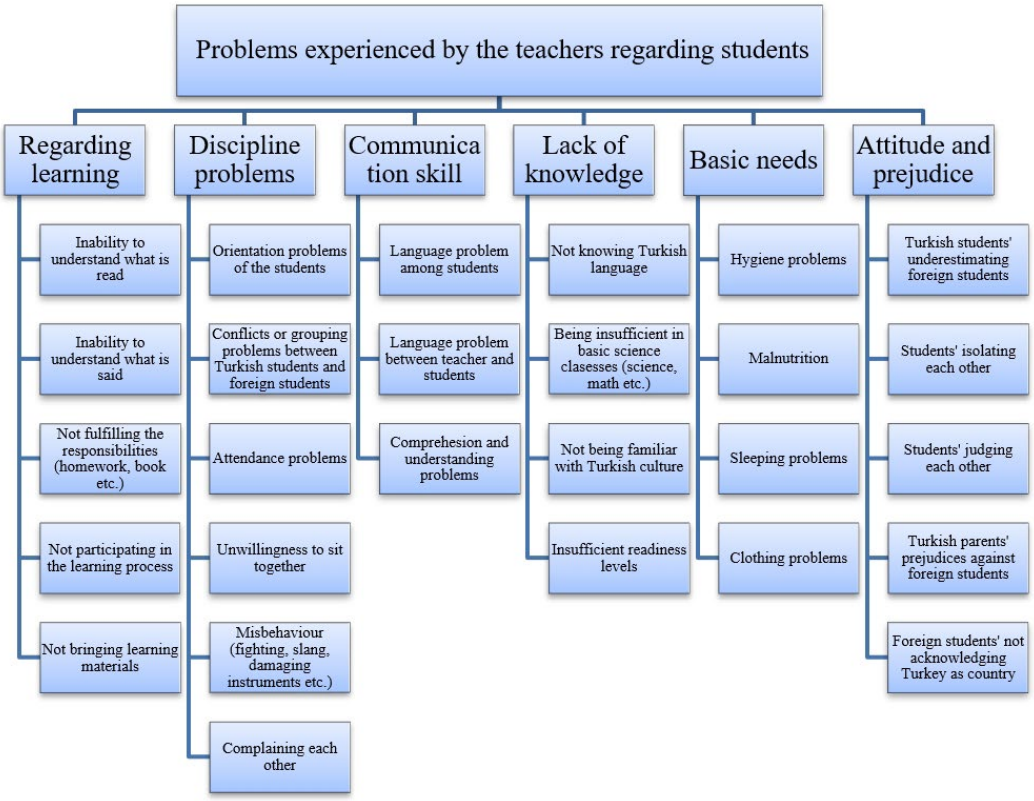

Figure 2: Problems experienced by the teachers in classrooms with primary school students from different cultural backgrounds in terms of students (source: own calculation)

Findings regarding problems experienced by the teachers in terms of parents

Problems experienced by the classroom teachers in classes with students from different cultures in terms of their parents were described in themes and subthemes in Figure 3. These problems were categorized under four subthemes, and, these are academic support, basic needs, communication skill, and attitude and prejudice (Figure 3).

When Figure 3 is analyzed, it is seen that inability to understand the reading activities, and inability to support their children are among the most occurred problems under the subtheme of academic support. Hygiene problems, and economic problems are among the most occurred problems under the subtheme of basic needs. Language related problems are among the most occurred problems under the subtheme of communication skill. Lastly, incomprehension of Turkish culture, and understanding of students are under the responsibility of schools are among the most occurred problems under the subtheme of attitude and prejudice. Views of the classroom teachers on problems regarding parents are as follows:

FT6: […] We organized parents' meeting, but most of them did not attend. Even though they come, they do not understand us as they cannot speak Turkish. We cannot communicate. […]

MT2: […] They say that our children are unable to learn due to other students. […]

FT3: […] We can say similar things for the parents as well. Parents had difficulty in accepting other student from different countries. They also questioned several hygiene issues […]

MT1: […] We have several furious and reacting parents. […]

FT4: […] though they say that they could not buy resources due to economic problems, they had everything interestingly. They said to one of my colleagues buy book for a student who did not have. Once our photocopier did not work, they said why did not you buy a new one! […]

FT5: […] Students have hygiene problems and you can easily recognize their problems. They do not care for themselves sufficiently. […]

Important points stressed by the classroom teachers regarding problems occurring in classrooms with students from different cultural backgrounds (final words)

Important points stressed by the classroom teachers regarding problems occurring in classrooms with students from different cultural backgrounds were presented in Figure 4. Educating foreign students in separate classes, training need on management of classroom having different cultural backgrounds, teaching primarily Turkish language to foreign students, need for assistant teachers, a separate curriculum for foreign students, and educating foreign students in a different classroom among points suggested by the classroom teachers. Final words provided by the classroom teachers are as follows:

FT4: […] I think that it would be better to have a second teacher in crowded classes. Teachers should be more tolerant. […]

MT2: […] We need to provide extra classes for these students […]

FT2: […] It would be better to provide education opportunities in schools specifically arranged for them with experienced teachers in order to overcome orientation problems easily. […]

FT1: […] Seminars focusing on specific teaching methods can be arranged for teachers as we do not have any idea how to teach. We do not know which curriculum we need to follow, our own curriculum or a specific one for them […]

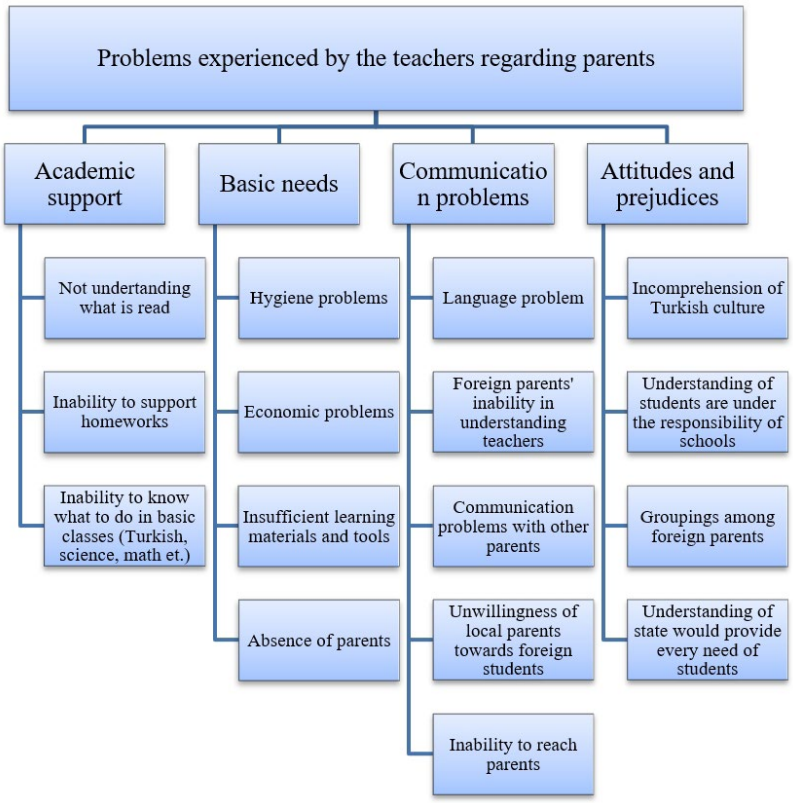

Figure 3: Problems experienced by the teachers in classrooms with primary school students from different cultural backgrounds in terms of parents (source: own calculation)

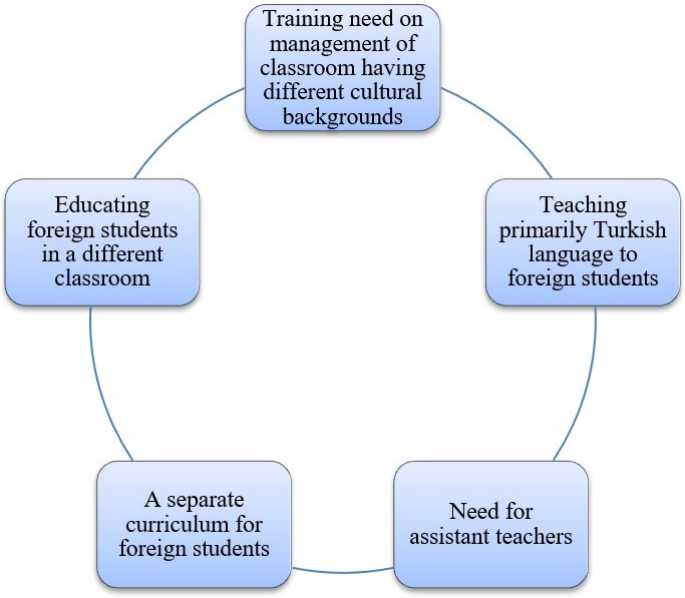

Figure 4: Final words by the classroom teachers regarding problems occurring in classrooms with students from different cultural backgrounds (source: own calculation)

DISCUSSION

The current study aimed at investigating the problems occurring at classroom contexts involving different cultures (Turkish, Iranian, Afghan and Syrian) studying together. In that respect, the findings were gathered under three categories: the problems occurring in multicultural contexts in terms of teachers, the problems in terms of students, and the problems in terms of parents.

When the problems experienced by teachers are analyzed, it can be said that there are problems in planning teaching and learning processes. *Lack of teaching experience* (inability to consider individual differences, inability to know what to teach at basic science classes such as math, science), *time management* (inability to spare enough time for teaching and dealing with students in classes sufficiently etc.), *classroom management* (chaos/disorders in classes, conflicts among native and foreign students, inability of foreign students to participate in learning processes etc.), *communication skill* (inability to understand students due to language differences, inability to communicate with students and their parents), and *attitudes and prejudices* (inability to acknowledge and show interest towards foreign students, etc.) are the areas that seem to have multidimensional problems. In this respect, it can be stated that the teachers who participated in the study have problems in conducting teaching-learning processes in which there are students from different cultural backgrounds successfully.

There may be many reasons for teachers to come across problems in leading teaching-learning processes having different cultures effectively. The first of these are knowledge and skills that teachers have. The participant teachers of this study stressed that they did not have any training during their university education on management of education contexts having different cultural backgrounds. For this reason, Hermans (2002) states that one of the basic responsibilities of teacher training programs is to prepare prospective teachers for multicultural classroom contexts. Also, Eryaman, Genc and Aktan (2011) stress that teacher education programs need to give more importance to multi-cultural education in order to better cope with the problems that stem from differences both in classrooms and society. A recent study indicated that more than half of the teachers do not feel themselves ready for lecturing to students from different cultural backgrounds (National Comprehensive Center for Teacher Quality and Public Agenda, 2008, cited in Nieto, 2009). Therefore, it is important to provide teachers and prospective teachers with necessary skills which enable them to design education contexts for students from different cultural backgrounds. Especially prospective teachers must have skills to develop culturally sensible teaching methods (Başbay and Bektaş, 2010). Besides, teacher education programs must be aware of their responsibilities of presenting better education contexts for multicultural classrooms and multicultural society reality (Hermans, 2002).

One of the reasons experienced by teachers may result from the fact that there are not any curricula that can be followed in education contexts involving different cultures. The curricula in Turkey are prepared centrally and have a standard nature. It can be said that the curricula are not flexible in terms of including intercultural awareness. For this reason, it is possible that teachers who have no experiences in intercultural education may have problems in education contexts. Similar findings were suggested in the study conducted by Aslan (2017). In the study, the teachers stated that they had problems resulting from curricula and constitutional concerns. Additionally, Manning, Baruth and Lee (2017) stated that educational materials that are compatible with students' cultural backgrounds are necessary in organizing a successful intercultural education context. These materials should contribute to students' identity developments, engage students in classroom activities, and present examples, words, and models regarding students' cultural backgrounds. Materials need to be original and multidimensional in order to help students to understand ethnical differences and cultural diversity. Furthermore, these materials should include both cognitive and affective skills (Manning, Baruth and Lee, 2017). Likewise, Gay (2000) states that school success will increase profoundly when education processes are compatible with cultural tendencies, experiences, and learning styles. This success is apparent in learning contexts where content regarding culture, teacher attitudes and expectations, and educational actions come together.

Another problem experienced by teachers in terms of intercultural education may stem from attitudes and prejudices towards different cultures due to insufficient experiences regarding knowing and recognition of features of other cultures. Most of the participant teachers expressed that they have no efforts in searching the cultures of their students. Besides, it can be said that they have prejudices towards foreign students after the observations conducted in math classes. Similar findings were revealed after the study conducted with Turkish teachers carried out by Aslan (2017). The participant teachers expressed that they do not have any information about parents, environments, and different cultures. However, one of the competencies that teachers must have regarding multiculturalism is the tendency on learning worldviews of the groups from different cultures (Başbay and Bektaş, 2010). Therefore, if teachers want to carry out a culturally sensitive effective teaching, they need to understand how ethnically different students learn (Gay, 2000). Attitudes form an important part of professional expertise of a multicultural teacher. Attitude as a phenomenon is mostly related with feelings, thinking ways, diversity in a classroom and a teacher's tendency towards communication (Sinagatullin, 2003). When teachers respect to differences and similarities, students get most of it. Teachers' searching and understanding intercultural and individual differences can contribute to students' learning motivations, students' willingness to show positive manners, and to develop a positive understanding towards their cultural past (Manning, Baruth and Lee, 2017). For this reason, teachers need to understand these students' values, traditions, and expectations in order to organize learning contexts comprising culturally different students in the same classes.

Next, classroom teachers experience some problems regarding students in education contexts with students from different cultural backgrounds. The problems caused by students involve learning problems, discipline problems, deficiencies in communication skills, inadequate knowledge, shortcomings in basic needs, and attitudes-prejudices. Especially misunderstandings due to language differences, foreign students' inability of adaptation to

classrooms, conflicts and groupings among local students and foreign students, inability to speak in Turkish, failures in basic sciences (science, math etc.), and insufficient knowledge in Turkish culture are among the problems experienced by teachers in terms of students. Similarly, malnutrition and hygiene, being despised by local students, students and parents' rejecting each other are among the substantial problems experienced by the teachers.

It can be said that teachers experience problems mostly caused by students during multicultural education. The most experienced problem is prejudices towards students from different cultures and disrespectful behaviors towards them by local students (Aslan, 2017). Similar problems are experienced in different countries as well (Manning, Baruth and Lee, 2017). It can be said that generally members of minority groups, students from the low-income families, students who are culturally different or speaking another language apart from English cannot obtain a proper place in the USA school system (Manning, Baruth and Lee, 2017). Whereas, individuals from different cultural backgrounds have chances of living a coherent life together by developing their knowledge and experiences as a result of communication at common life areas (Gencer, 2011). Especially, cooperative learning processes can enhance school studies of culturally different students. Cooperative learning fosters communication among students, provides feeling of group membership, engages learners in joyful activities, and directs group members for a common goal (Manning, Baruth and Lee, 2017). A recent study showed that students can apply different cultural roles and understand lives of individuals from different cultures through presentations, games, and drama performed in classrooms. The study also revealed that it is possible to bring students in attitudes, skills, and behaviors positively towards multiculturalism by planning multicultural education contexts (Aktın et al., 2015). Above all, it is under the responsibility of the schools to develop an insight for each student and to maintain teaching and learning experiences effectively (Manning, Baruth and Lee, 2017).

A number of teachers and teacher trainers express that they come across incompatible cultural diversity in subjects (especially math and science) covered during teaching and learning processes, or many notional problems arising from unifying subjects. This cannot be accepted as there is always a place to foster cultural diversity in each subject taught at schools (Gay, 2002). Moreover, students need both time and support to overcome problems and to be successful in academic areas in the education contexts comprising different cultures (DomNwachukwu, 2010; Spinthourakis and Karakatsanis, 2011). Language learning has a critical role by taking longer times than other areas contrary to what people believe. Reading develops simultaneously with teaching of writing skill (Gay, 2000; Spinthourakis and Karakatsanis, 2011). Teachers can overcome the problems regarding students by supporting language acquisition effectively.

Parent based problems are also among the problems faced by teachers in classroom contexts having students from different cultures. Foreign parents' inability to speak Turkish language and to support their children academically are important problems experienced by the teachers. Also, language-based problems complicate the communication among family, school, and teachers. Communication problems bring along other problems regarding attitudes and prejudices. Staying away from Turkish culture can create attitudes and prejudices for foreign parents. Koustelini (2011) states that increasing migration flows can cause possible xenophobic attitudes and negative consequences. Migrants especially from non-European countries are generally more affected from these negative behaviors and feelings than the European origin migrants. This can be explained through low economic conditions of their countries, lifestyles, and great differences in their value systems. Nevertheless, the inclusion of families in multicultural education is important because this emphasize the value of their children in their lives, understands differences in ethics and insights in society, provides an instrument to solve problems cooperatively, enhances opportunities for all students to learn at schools (Banks, 2015). Participating in classroom activities, preparing extra-curricular activities, paired reading, artistic, musical, dramatic, linguistic or scientific and technologic programs, supporting distribution of ethnic curriculum, maintaining school facilities, serving in executive committee and other committees hold crucial importance for parents. Parents' taking parts in these activities insofar strengthen the relationship between school and its immediate surroundings (Lalor and Mulcahy, 2011).

Several problematic issues experienced by the teachers at education contexts with students from different cultural backgrounds in Turkey were reported in the current study. When we consider the migration trends and refugee problems across the world, the obtained findings in this study can help to prevent possible problems that may arise due to insufficient experience on intercultural, multicultural education contexts by giving insights to policy makers, program developers, professionals, stakeholders, and school directors.

CONCLUSION

This study investigated the problems faced by teachers in classrooms where students with different cultural backgrounds study together. The results indicate that the problems stemmed from mainly three areas; the problems regarding teachers themselves, the problems regarding students, and the problems regarding students' parents. Teaching inexperience, time management, classroom management, communication skill, and attitudes and prejudices were among the problems experienced by the teachers related to themselves. Learning problems, discipline problems, communication skill, insufficient knowledge, basic needs, and attitudes and prejudices were among the problems experienced by the teachers in terms of students. Academic support, basic needs, communication skill, and attitude and prejudice were among the problems experienced by the teachers in terms of parents. Based on these conclusions, several suggestions can be proposed. Revealing teachers' problems and taking necessary steps to eliminate these problems may contribute positively to education contexts with students from different cultures. Seminars and in-service training programs regarding teaching to students from different cultures may contribute to professional developments of teachers. Redesigning teacher education programs in an intercultural/multicultural friendly way may eliminate anticipated problems for preservice teachers in their future professional lives.

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