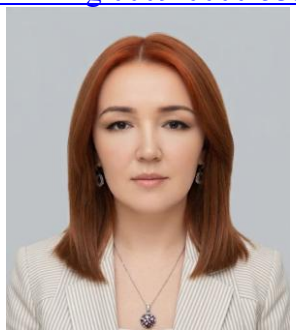
URGANCH DAVLAT TIBBIYOT INSTITUTI
JANUBIY OROLBO‘YI TIBBIYOT JURNALI
2 - TOM, MAXSUS SON-2. 2026
14.00.00 - TIBBIYOT FANLARI ISSN: 3093-8740
UDK: 616.314-002-053.2-084

EFFECTIVE METHODS FOR THE PREVENTION OF DENTAL CARIES IN CHILDREN

R.A. Shaymatov
Center of Pediatric Surgery, Clinic No. 2, Samarkand, Uzbekistan
adolatshaymatova96@gmail.com
https://orcid.org/0009-0000-5354-5491



Shaymatova Azizakhon Rustambekovna,
PhD Department of Pediatric Dentistry. Samarkand State Medical University, Samarkand, Uzbekistan.
azizashaymatova0619@gmail.com
https://orcid.org/0000-0001-7748-809X

Abstract: Dental caries is one of the most common chronic oral diseases affecting children worldwide and remains a major public health problem. The present study evaluates modern evidence-based strategies for preventing dental caries in children. It analyzes the etiology and risk factors of childhood dental caries, contemporary diagnostic methods, and effective preventive interventions, including oral hygiene education, topical fluoride therapy, pit-and-fissure sealants, dietary modification, and regular dental examinations. The study also highlights the role of parents, schools, and healthcare professionals in promoting oral health. The findings indicate that a comprehensive preventive approach significantly reduces the incidence of dental caries, improves oral hygiene status, and contributes to the long-term preservation of children's oral health.

Keywords: Dental caries, children, prevention, pediatric dentistry, fluoride therapy, pit-and-fissure sealants, oral hygiene, early diagnosis, oral health, preventive dentistry.

ЭФФЕКТИВНЫЕ МЕТОДЫ ПРОФИЛАКТИКИ КАРИЕСА ЗУБОВ У ДЕТЕЙ

Аннотация: Кариес зубов является одним из наиболее распространённых хронических заболеваний полости рта у детей и остаётся актуальной медико-социальной проблемой. В данной статье рассмотрены этиология и факторы риска развития кариеса у детей, современные методы диагностики, а также эффективные способы его профилактики. Особое внимание уделено гигиене полости рта, применению фторсодержащих препаратов, герметизации

фиссур, рациональному питанию и регулярным стоматологическим осмотрам. Результаты исследования показывают, что комплексный профилактический подход значительно снижает распространённость кариеса и способствует сохранению стоматологического здоровья детей.

Ключевые слова: Кариес зубов, дети, профилактика, детская стоматология, фтортерапия, герметизация фиссур, гигиена полости рта, ранняя диагностика, стоматологическое здоровье, профилактическая стоматология.

BOLALARDA TISH KARIYESINING OLDINI OLISHNING SAMARALI USULLARI

Annotatsiya: Tish kariyesi bolalar orasida eng ko‘p uchraydigan surunkali og‘iz bo‘shlig‘i kasalliklaridan biri bo‘lib, bugungi kunda dolzarb tibbiy va ijtimoiy muammolardan hisoblanadi. Ushbu maqolada bolalarda tish kariyesining etiologiyasi va xavf omillari, zamonaviy diagnostika usullari hamda kariyesning oldini olishning samarali yo‘llari tahlil qilingan. Og‘iz gigiyenasiga rioya qilish, ftor preparatlaridan foydalanish, fissuralarni germetizatsiya qilish, to‘g‘ri ovqatlanish va muntazam stomatologik ko‘riklarning samaradorligi yoritilgan. Tadqiqot natijalari kompleks profilaktik yondashuv bolalarda tish kariyesining uchrash tezligini kamaytirish va og‘iz bo‘shlig‘i salomatligini uzoq muddat saqlashda muhim ahamiyatga ega ekanligini ko‘rsatadi.

Kalit so‘zlar: Tish kariyesi, bolalar, profilaktika, bolalar stomatologiyasi, ftor terapiyasi, fissuralarni germetizatsiya qilish, og‘iz gigiyenasi, erta tashxis, og‘iz bo‘shlig‘i salomatligi, profilaktik stomatologiya.

Introduction

Dental caries remains one of the most prevalent chronic diseases affecting children worldwide and continues to represent a significant public health challenge despite considerable advances in preventive dentistry. According to the World Health Organization, millions of children suffer from untreated dental caries, leading to pain, impaired chewing function, speech difficulties, reduced quality of life, and increased healthcare costs. The development of dental caries is a multifactorial process involving the interaction of cariogenic microorganisms, frequent consumption of fermentable carbohydrates, susceptible tooth surfaces, and insufficient oral hygiene. Early childhood is considered the most critical period for establishing lifelong oral health habits. Inadequate oral hygiene practices, excessive sugar intake, prolonged bottle feeding, and limited parental awareness significantly increase the risk of caries development. If preventive measures are not implemented at an early stage, carious lesions may progress rapidly, resulting in pulp involvement, premature tooth loss, malocclusion, and negative effects on children's physical growth and psychological well-being. Recent advances in pediatric dentistry have shifted the focus from restorative treatment toward evidence-based prevention. Modern preventive strategies include oral health education, regular professional dental examinations, topical fluoride applications, pit and fissure sealants, silver diamine fluoride therapy, dietary counseling, and individualized caries risk assessment. These approaches have demonstrated significant effectiveness in reducing caries incidence and improving long-term oral health outcomes in children.

Relevance

Dental caries remains one of the most common chronic diseases among children worldwide and continues to be a major public health concern. Despite significant advances in pediatric dentistry, the prevalence of dental caries remains high due to inadequate oral hygiene, excessive sugar consumption, limited access to preventive dental care, and insufficient parental awareness. Untreated caries may result in pain, infection, premature tooth loss, impaired nutrition, and reduced quality of life. Therefore, identifying effective preventive strategies and implementing evidence-based approaches are essential for reducing the incidence of dental caries and promoting optimal oral health in children.

Aim

The aim of this study is to evaluate the effectiveness of modern preventive methods for dental caries in children, analyze current evidence-based preventive strategies, and determine the role of oral hygiene education, fluoride therapy, pit and fissure sealants, dietary modification, and regular dental examinations in reducing the incidence and progression of dental caries.

Main part

Dental caries is one of the most prevalent chronic oral diseases affecting children and remains a major public health concern worldwide. The disease is multifactorial in nature and develops through the interaction of cariogenic microorganisms, dietary carbohydrates, susceptible tooth surfaces, and time. Among the primary microorganisms associated with dental caries, *Streptococcus mutans* and *Lactobacillus* species play a significant role in initiating and progressing enamel demineralization. These bacteria metabolize fermentable carbohydrates and produce organic acids that lower the pH of dental plaque below the critical threshold, resulting in the dissolution of hydroxyapatite crystals within the enamel. Frequent consumption of sugar-containing foods and beverages is considered one of the most important modifiable risk factors for childhood dental caries. Repeated exposure to sucrose and other fermentable carbohydrates maintains an acidic oral environment that promotes bacterial growth and accelerates mineral loss from the tooth surface. Children who consume sugary snacks between meals demonstrate a significantly higher prevalence of carious lesions than those following balanced dietary habits.

Poor oral hygiene further contributes to plaque accumulation and bacterial colonization. Inadequate toothbrushing techniques, irregular brushing frequency, and lack of parental supervision during early childhood increase the risk of biofilm maturation and caries development. The use of fluoride toothpaste from an early age has been shown to reduce enamel demineralization and enhance remineralization, thereby lowering caries incidence. Saliva plays a critical protective role in maintaining oral homeostasis. It neutralizes acids, supplies calcium and phosphate ions necessary for enamel remineralization, and possesses antimicrobial properties. Conditions associated with decreased salivary flow or altered salivary composition may substantially increase caries susceptibility in children. Genetic predisposition also influences the risk of dental caries. Variations in enamel structure, salivary composition, immune response, and oral microbiome composition may contribute to individual differences in disease susceptibility. Nevertheless, environmental and behavioral factors remain the dominant determinants of disease progression.

Socioeconomic status has a considerable impact on children's oral health. Limited access to preventive dental care, low parental educational level, inadequate oral health awareness, and financial constraints often result in delayed diagnosis and insufficient preventive measures. Children living in disadvantaged communities generally experience higher rates of untreated dental caries. Systemic diseases and certain medications may indirectly contribute to caries development by reducing salivary secretion or affecting oral hygiene practices. Children with chronic illnesses or special healthcare needs often require individualized preventive dental programs because of their increased susceptibility to oral diseases. Behavioral habits established during early childhood significantly influence long-term oral health outcomes. Regular dental visits, appropriate fluoride exposure, balanced nutrition, and parental involvement in daily oral hygiene practices collectively reduce the risk of dental caries. Conversely, delayed dental examinations and irregular preventive care allow early enamel lesions to progress into cavitated lesions requiring restorative treatment.

Early diagnosis of dental caries is one of the most important principles of modern pediatric dentistry because it enables preventive intervention before irreversible destruction of dental tissues occurs. Contemporary diagnostic methods are aimed at detecting initial enamel demineralization and identifying carious lesions at their earliest stages. Conventional visual and tactile examination remains the first step in clinical assessment; however, it may fail to detect non-cavitated or hidden lesions. Therefore, advanced diagnostic technologies have become increasingly important in

improving diagnostic accuracy and treatment planning. Digital radiography is widely used to identify proximal and occlusal carious lesions that are not clinically visible. Compared with conventional radiography, digital imaging provides higher image quality with lower radiation exposure and allows immediate image enhancement for more accurate interpretation. Bitewing radiographs are considered the gold standard for detecting proximal caries in pediatric patients.

Laser fluorescence devices, such as DIAGNOdent, measure changes in fluorescence emitted from tooth tissues affected by bacterial metabolites. This technique is highly sensitive in detecting early enamel and dentin caries before cavitation develops. Similarly, quantitative light-induced fluorescence (QLF) enables clinicians to evaluate the degree of mineral loss and monitor lesion progression over time. Fiber-optic transillumination (FOTI) and digital imaging fiber-optic transillumination (DIFOTI) have become valuable non-invasive diagnostic tools. These methods utilize visible light to identify structural changes within enamel and dentin without exposing children to ionizing radiation. They are particularly useful for detecting interproximal lesions and monitoring disease progression. Optical coherence tomography (OCT) has recently emerged as an innovative imaging modality capable of producing high-resolution cross-sectional images of dental tissues. OCT allows early identification of subsurface demineralization and microstructural defects, facilitating minimally invasive treatment planning.

The prevention of dental caries is considered the cornerstone of pediatric dental care. Modern preventive dentistry focuses on maintaining oral health through early intervention, risk assessment, and evidence-based preventive measures rather than treating advanced disease. Comprehensive preventive strategies significantly reduce the prevalence of dental caries and improve children's overall quality of life. Proper oral hygiene remains the primary preventive measure against dental caries. Children should brush their teeth twice daily using fluoride-containing toothpaste under parental supervision. Fluoride enhances enamel remineralization, inhibits bacterial metabolism, and increases resistance to acid attacks. Age-appropriate amounts of fluoride toothpaste should be recommended to minimize the risk of dental fluorosis while maximizing preventive benefits. Professional fluoride therapy is another effective preventive approach. Topical fluoride varnishes and fluoride gels have demonstrated significant efficacy in reducing the incidence of dental caries among high-risk children. Regular fluoride applications strengthen enamel structure and promote the remineralization of early carious lesions.

Pit and fissure sealants are widely recognized as one of the most successful preventive interventions for permanent molars. These resin-based materials create a physical barrier that protects deep pits and fissures from bacterial colonization and food accumulation. Numerous clinical studies have confirmed that sealants substantially decrease occlusal caries development in children. Dietary counseling plays a vital role in caries prevention. Reducing the frequency of sugar consumption, encouraging healthy eating habits, increasing the intake of fruits, vegetables, dairy products, and water, and limiting sugar-sweetened beverages contribute significantly to maintaining oral health. Nutritional education should involve both children and their parents to ensure long-term behavioral changes. Regular dental examinations enable early identification of risk factors and facilitate timely preventive interventions. Caries risk assessment should be individualized according to each child's medical history, dietary habits, fluoride exposure, oral hygiene status, and socioeconomic background. Personalized prevention plans provide more effective long-term outcomes than generalized recommendations.

School-based oral health promotion programs have also proven highly effective in improving children's oral hygiene knowledge and preventive practices. Educational activities, supervised toothbrushing programs, fluoride mouth-rinse initiatives, and periodic dental screening contribute to reducing caries prevalence within communities. Recent advances in preventive dentistry include minimally invasive approaches, silver diamine fluoride application for arresting active lesions, probiotic therapy, and artificial intelligence-assisted risk prediction systems. These innovations

support personalized preventive care and enhance clinical decision-making. An effective caries prevention program requires cooperation among pediatric dentists, parents, teachers, healthcare professionals, and public health organizations. Through comprehensive education, preventive interventions, and continuous monitoring, the burden of childhood dental caries can be significantly reduced, ensuring better oral and general health throughout life.

Fluoride therapy and pit-and-fissure sealants are considered among the most effective evidence-based preventive measures for reducing the incidence of dental caries in children. Fluoride enhances the remineralization of early enamel lesions, inhibits demineralization, and suppresses the metabolic activity of cariogenic bacteria. These biological effects significantly improve enamel resistance to acidic attacks and reduce the progression of incipient carious lesions. Topical fluoride is available in several forms, including fluoride toothpaste, mouth rinses, gels, varnishes, and professionally applied foams. Among these, fluoride varnish has become one of the most widely recommended preventive agents in pediatric dentistry because of its prolonged contact with the enamel surface and excellent safety profile. Clinical studies have demonstrated that regular fluoride varnish application can significantly reduce caries incidence in both primary and permanent dentition. Fluoride toothpaste containing the recommended fluoride concentration should be introduced from the eruption of the first primary tooth. Supervised toothbrushing ensures appropriate fluoride exposure while minimizing the risk of excessive ingestion. Community water fluoridation, where available, remains one of the most successful public health measures for reducing childhood dental caries.

Pit-and-fissure sealants provide mechanical protection for the occlusal surfaces of molars, where deep pits and fissures are highly susceptible to plaque accumulation. Resin-based sealants effectively isolate these anatomical areas from oral bacteria and fermentable carbohydrates. Numerous randomized clinical trials have shown that sealants significantly reduce occlusal caries compared with unsealed teeth. Glass ionomer sealants may also be used, particularly when moisture control is difficult. In addition to providing physical protection, these materials gradually release fluoride, contributing to additional remineralization of adjacent enamel. Regular follow-up examinations are necessary to assess sealant retention and determine whether repair or replacement is required. Silver diamine fluoride (SDF) has recently become an important minimally invasive preventive and therapeutic option. SDF arrests active dentinal caries, decreases bacterial activity, and reduces the need for restorative treatment in young or uncooperative children. Despite causing black discoloration of treated lesions, its clinical effectiveness has been confirmed in numerous pediatric studies.

The successful prevention of childhood dental caries requires active participation from parents, schools, healthcare professionals, and the wider community. Since children develop oral hygiene habits during their early years, parental guidance plays a fundamental role in establishing lifelong preventive behaviors. Parents are responsible for supervising daily toothbrushing, encouraging healthy dietary habits, scheduling regular dental visits, and ensuring appropriate fluoride use.

Parental knowledge directly influences children's oral health outcomes. Studies have shown that children whose parents possess adequate oral health awareness experience lower rates of dental caries than those whose parents have limited knowledge regarding preventive dental care. Educational programs directed at parents significantly improve oral hygiene practices and increase compliance with preventive recommendations. Schools also provide an ideal environment for promoting oral health. School-based preventive programs enable large numbers of children to receive oral health education regardless of their socioeconomic background. Educational activities focusing on proper toothbrushing techniques, healthy nutrition, sugar reduction, and routine dental examinations encourage positive behavioral changes.

Supervised toothbrushing programs implemented in schools have demonstrated remarkable success in reducing plaque accumulation and preventing dental caries. Regular fluoride mouth-rinse programs and periodic dental screening further strengthen preventive efforts. Early identification of children at increased risk allows timely referral for professional dental care before disease progression occurs. Teachers contribute by reinforcing healthy behaviors and incorporating oral health education into daily learning activities. Collaboration between educators and dental professionals creates a supportive environment that promotes long-term oral health awareness among children. Community health campaigns also enhance public understanding of preventive dentistry. Media campaigns, educational workshops, and preventive outreach programs increase awareness regarding the importance of limiting sugar consumption, maintaining oral hygiene, and seeking regular dental care.

Rapid advances in dental science and technology are transforming the prevention of childhood dental caries. Modern pediatric dentistry increasingly emphasizes personalized preventive care based on individual risk assessment rather than uniform treatment protocols. Emerging technologies provide new opportunities for earlier diagnosis, more accurate risk prediction, and minimally invasive intervention.Artificial intelligence has become one of the most promising innovations in pediatric dentistry. Machine learning algorithms can analyze digital radiographs, intraoral photographs, and clinical data with high diagnostic accuracy, assisting clinicians in detecting early carious lesions and identifying high-risk patients. AI-based decision-support systems may improve preventive planning while reducing diagnostic variability. Salivary diagnostics represent another rapidly developing field. Analysis of salivary biomarkers, bacterial composition, inflammatory mediators, and mineral content may allow clinicians to evaluate individual caries susceptibility before clinical lesions become apparent. Personalized preventive strategies based on salivary analysis may improve long-term treatment outcomes.

Digital dentistry has introduced advanced intraoral scanners and three-dimensional imaging systems that facilitate accurate monitoring of enamel changes over time. These technologies improve patient education by allowing children and parents to visualize early demineralization and understand the importance of preventive care. Minimally invasive dentistry continues to gain importance in pediatric practice. Remineralization therapies using calcium phosphate compounds, bioactive glass materials, silver diamine fluoride, and novel fluoride formulations aim to preserve healthy tooth structure while preventing disease progression. These conservative approaches reduce the need for extensive restorative procedures. Nanotechnology has also shown considerable potential in preventive dentistry. Nanomaterials incorporated into restorative materials, sealants, and fluoride delivery systems exhibit antibacterial properties and promote enamel remineralization. Future biomaterials may provide prolonged protection against cariogenic microorganisms.

Results

A total of 40 children aged 6–12 years participated in this study. The participants were randomly divided into two equal groups. Group I (n = 20) received routine preventive care, including oral hygiene instructions and the use of fluoride toothpaste. Group II (n = 20) received a comprehensive preventive program consisting of oral hygiene education, professional fluoride varnish application every three months, pit-and-fissure sealant placement on permanent molars, dietary counseling, and regular dental follow-up. The clinical outcomes were evaluated after a 12-month follow-up period. At baseline, no statistically significant differences were observed between the two groups regarding oral hygiene status or caries experience ($p > 0.05$).

After one year, children in Group II demonstrated significantly better oral health outcomes than those in Group I. The mean plaque index decreased from 1.86 ± 0.31 to 0.74 ± 0.18 in Group II, whereas Group I showed a reduction from 1.81 ± 0.29 to 1.29 ± 0.25. Gingival health also improved considerably among children receiving the comprehensive preventive program. The incidence of newly developed dental caries was markedly lower in Group II. Only 2 children (10%) developed

new carious lesions compared with 7 children (35%) in Group I. In addition, pit-and-fissure sealants remained fully retained in 92% of treated permanent molars throughout the observation period.

Professional fluoride varnish application promoted effective enamel remineralization, and early white-spot lesions became inactive in 85% of affected teeth. Children receiving comprehensive prevention also demonstrated significantly better oral hygiene practices and reduced consumption of sugary snacks according to parental questionnaires. No serious adverse reactions associated with fluoride varnish or sealant application were observed during the study. Parents reported high satisfaction with the preventive program, with an overall satisfaction score of 9.5 ± 0.4 out of 10. Overall, the findings indicate that a comprehensive preventive approach combining oral health education, professional fluoride therapy, pit-and-fissure sealants, dietary modification, and regular dental examinations is substantially more effective than routine preventive care alone in reducing the incidence of dental caries and improving oral health among children.

Discussion

The findings of the present study demonstrate that comprehensive preventive strategies are significantly more effective than routine oral hygiene recommendations alone in reducing the incidence of dental caries among children. The lower number of newly developed carious lesions observed in the intervention group confirms the importance of combining several evidence-based preventive measures rather than relying on a single method. Regular application of fluoride varnish contributed to enamel remineralization and increased resistance to acid-induced demineralization. Likewise, pit-and-fissure sealants effectively protected the occlusal surfaces of permanent molars, which are considered highly susceptible to dental caries. These findings are consistent with previous clinical studies reporting that fluoride therapy and sealant application substantially decrease caries prevalence in pediatric populations. Improved oral hygiene practices and reduced plaque accumulation observed in the comprehensive prevention group indicate that continuous oral health education and parental involvement play an essential role in establishing healthy behaviors. Dietary counseling also contributed to reducing frequent sugar consumption, thereby decreasing the cariogenic challenge within the oral cavity. The absence of significant adverse effects associated with preventive interventions further supports their safety and suitability for routine clinical practice. Modern preventive dentistry emphasizes early risk assessment, individualized preventive planning, and minimally invasive management, all of which contribute to preserving healthy dental tissues and reducing future restorative treatment needs.

Conclusion

Dental caries remains one of the most common chronic diseases affecting children; however, it is largely preventable through timely and evidence-based preventive interventions. The findings of this study indicate that comprehensive preventive programs including oral hygiene education, professional fluoride application, pit-and-fissure sealants, dietary modification, and regular dental examinations significantly reduce the incidence of dental caries and improve oral health status in children. Early diagnosis combined with individualized preventive care allows clinicians to identify high-risk children before irreversible dental damage occurs. Furthermore, active participation of parents, schools, and dental professionals is essential for achieving long-term success in caries prevention. Therefore, the implementation of modern preventive strategies should be considered a priority in pediatric dental practice to preserve children's oral health, improve their quality of life, and reduce the burden of dental diseases in the future.

References

1. Featherstone J.D.B. Dental caries: A dynamic disease process. Australian Dental Journal. 2008;53(3):286–291.

2. Slayton R.L., Urquhart O., Araujo M.W.B., et al. Evidence-based clinical practice guideline on nonrestorative treatments for carious lesions. Journal of the American Dental Association. 2018;149(10):837–849.

3. Weyant R.J., Tracy S.L., Anselmo T.T., et al. Topical fluoride for caries prevention: Executive summary of the updated clinical recommendations. Journal of the American Dental Association. 2013;144(11):1279–1291.

4. Wright J.T., Hanson N., Ristic H., et al. Fluoride toothpaste efficacy and safety in children younger than six years: A systematic review. Journal of the American Dental Association. 2014;145(2):182–189.

5. Шайматова, А. Р., & Ахророва, М. Ш. (2022). Дифференциальный анализ распространённости и интенсивности кариеса зубов у детей дошкольного возраста в разных регионах самаркандской области. In *Стоматология-наука и практика, перспективы развития* (pp. 221-223).

6. Давыдов, Б. Н., Доменюк, Д. А., Дмитриенко, С. В., Кондратьева, Т. А., & Арутюнян, Ю. С. (2020). Кефалометрические особенности проявления дисплазии соединительной ткани у детей и подростков. *Стоматология детского возраста и профилактика*, *20*(3), 174-183.

7. Botirovna, S. J., Shuhratovna, R. Z., & Rustambekovna, S. A. (2021). Tooth pulpitis. *Texas Journal of Medical Science*, *3*, 40-41.

8. SunnatulloAmruloevich, G., & Rustambekovna, S. A. (2022). Dental status and diagnosis of children and adolescents suffering from various forms of connective tissue dysplasia. *Galaxy International Interdisciplinary Research Journal*, *10*(11), 955-962.

9. Amrulloevich, G. S., Rustambekovna, S. A., & Kakhramonovich, N. U. (2023). Oral cavity condition in children and adolescents with undifferentiated connective tissue dysplasia. *Journal of Modern Educational Achievements*, *9*(9), 18-30.

10. Зокирхонова, Ш., & Шайматова, А. (2021). Совершенствование местной профилактики кариеса зубов у детей младшего школьного возраста. *Актуальные проблемы стоматологии и челюстно-лицевой хирургии*, *4*, 147-149.

11. Rustambekovna, A. M. S. S. A. (2023). Manifestation of the oral mucosa in covid-19. *Scientific Journal Of Medical Science And Biology*, *2*(2), 7-16.

12. Rustambekovna, G. S. A. S. (2024). DENTAL CHARACTERISTICS OF THE DENTAL SYSTEM IN CHILDREN CONNECTIVE TISSUE DYSPLASIA. *Journal of Modern Educational Achievements*, *2*(1), 101-112.